PHYTOLOGIA

An international journal to expedite plant systematic, phytogeographical and ecological publication

Vol.70 January 1991 No.1

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Published by Michael J. Warnock
185 Westridge Drive Huntsville, Texas 77340 U.S.A.
PHYTOLOGIA is printed on acid free paper.

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PHYTOLOGIA (ISSN 00319430) is published monthly by Michael J. Warnock, 185 Westridge Drive, Huntsville, TX 77340-8916. Second Class postage at Huntsville, TX. Domestic individual subscription (6 issues): $18.00. Domestic institutional subscription (6 issues): $20.00. Foreign and/or airmail postage extra. Single copy sales: Current issue and back issues volume 67 to present, $3.50; Back issues (previous to volume 67), $3.00 (add $.50 per copy postage and handling US [$1.00 per copy foreign]). Back issue sales by volume: $17.00 per volume 42-66 (not all available as complete volumes); $21.00 per volume 67-present; add $2.00 per volume postage US ($4.00 per volume foreign). POSTMASTER: Send address changes to Phytologia, 185 Westridge Drive,Huntsville, TX 77340-8916.

Phytologia (January 1991) 70(1):1-20.

TAXONOMY OF *GENTIANELLA* (GENTIANACEAE) IN MÉXICO

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ABSTRACT

The taxonomy is detailed for the twelve Mexican species of *Gentianella* (excluding *Gentianopsis*). Among them are four new species, **Gentianella calycidon, Gentianella fimbrilinguis, Gentianella glossocarpa,** and **Gentianella tarahumarae,** as well as **Gentianella sandiana** *comb. et stat. nov.* Distribution maps are included.

KEY WORDS: *Gentianella*, Gentianaceae, México

A detailed revision of the North American species of *Gentianella* was provided by Gillett (1957), but both his generic and species concepts have been considerably restricted by later students of the Gentianaceae. Particularly, the segregation of *Gentianella* subgenus *Eublephis*, the "fringed gentians," as *Gentianopsis* (Ma 1951) has been generally recognized as justified (Iltis 1965). *Gentianella* subgenus *Comastoma* also has been segregated as a separate genus (Tokokuni 1961; other transfers by Holub 1967), but these species have generally been retained within *Gentianella* in recent floristic treatments (*e.g.*, Holmgren 1984).

Gentianella and *Gentianopsis* both differ from *Gentiana* in their epipetalous nectar glands, corollas without conspicuous folded plaits between the lobes, and calyx tubes usually without an inner membranous rim. Based on these features, both genera are perhaps more closely related to *Frasera* and *Swertia* than to *Gentiana* (Tokokuni 1963). *Gentianella* differs from *Gentianopsis* in its much smaller corollas and smooth (vs. papillose) seeds.

Gentianella is a cosmopolitan genus comprising about 100-125 species of temperate regions. The greatest number of species are found in South America, which were treated in large part by the studies of Fabris (1960) and Pringle (1981). Other centers of lower diversity are in North America, Europe, and Asia. Eleven species of *Gentianella* occur in North America north of México (Kartesz & Kartesz 1980) and twelve in México; four of these cross the international border in their distribution. A number of these represent taxa raised from subspecific rank (*sensu* Gillett 1957) to specific rank by Holub (1967).

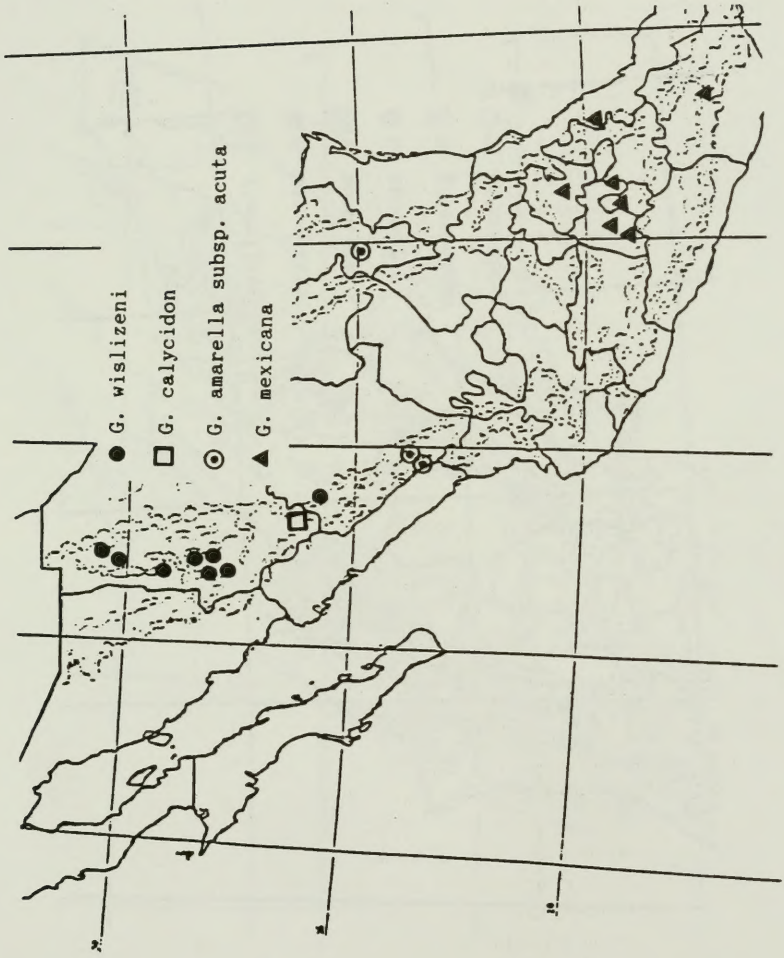
The latter worker provided only a short paper that presented many new combinations but no discussion or explanation of the taxonomic decisions. The present study evaluates and summarizes the taxonomy of the Mexican species.

In my overview, all of the Mexican taxa recognized by Gillett are accepted, but all except one are recognized at the specific rank; however, some of the collections studied by Gillett are identified differently. Four new species are recognized, in addition to another recently described in a separate paper (Nesom & Turner 1990). Several of the species appear to be somewhat variable in morphology, but all are distinct and there is no evidence of intergradation among any of the taxa. In Mexico, species of *Gentianella* that are most closely similar among themselves appear to be allopatric (Maps 1-3) and consequently have little or no opportunity to hybridize. Many of these species apparently are extremely narrow in their geographic distribution and at least three are probably in immediate danger of extinction.

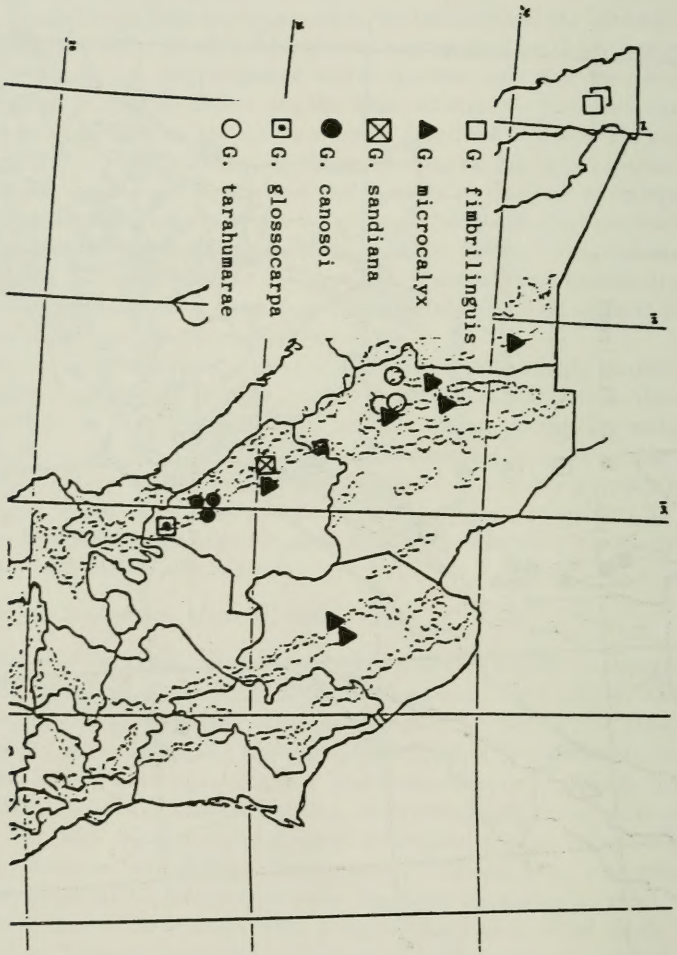
Plants of the Mexican species of *Gentianella* are notably similar in their vegetative morphology, and as seen in the key and reflected in the descriptions, features that distinguish the taxa are almost completely restricted to the flowers and fruits. Among the species included here, the color of fresh corollas appears to be either primarily yellowish or variably purplish to bluish to nearly white. The pigments, however, have a strong tendency to become yellowish when dry, and use of flower color in the identification of dried specimens is not particularly reliable.

Gentianella Moench, *Meth. Pl.* 482. 1794.

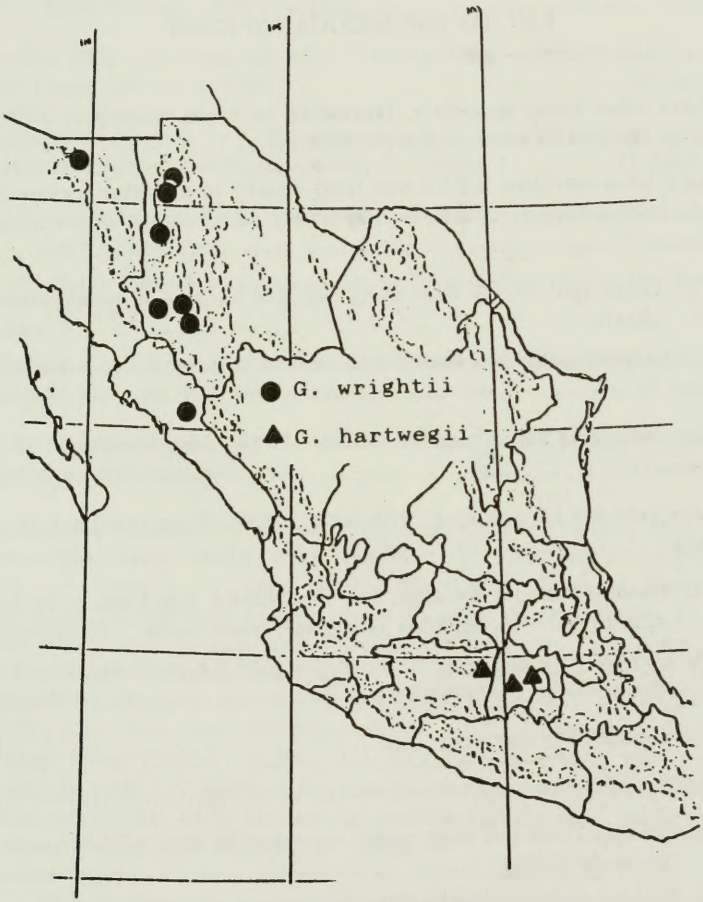
Taprooted annuals, glabrous, smooth or minutely papillate-scabrous. Stems erect, simple from the base or rarely few branched, often ridged. Leaves opposite, epetiolate, commonly subclasping, entire, 3-5 nerved, the basal usually absent by flowering [in the Mexican taxa]. Flowers (4-) 5-merous, convolute in bud, mostly in compact, axillary and terminal cymes, pedicels longest on the lower nodes; calyx usually with a short tube, lacking an inner membranous rim, with lobes equal or unequal in length; corollas yellow to purplish blue, tubular to funnelform or campanulate, 5-25 mm long, with epipetalous nectar glands at the base of the tube, the lobes spreading to erect, without plicae in the sinuses, usually with a row of fimbriae inserted at the base of the lobes. Stamens epipetalous, the filaments often narrowly winged basally, often adnate for about half the corolla tube length, the anther thecae 0.6-1.0 mm long, positioned near the apex of the throat, included within the tube or barely exserted. Ovaries unilocular, placentation parietal, the 2 stigmas persistent on the fruit apex; fruits sessile or short stipitate, usually slightly exserted from the corolla, capsular, 2 valved, septicidal, apically dehiscent. Seeds numerous, 0.6-1.0 mm long, brownish, more or less smooth, round to slightly flattened. Base chromosome number, $x = 9$ in subg. *Gentianella* (see comments by Pringle 1981), $x = 5$ in subg. *Comastoma*.



Map 1


G. fimbrilinguis
G. microcalyx
G. sandiana
G. canosoi
G. glossocarpa
G. tarahumarae

Map 2



Map 3

Type species, *Gentianella tetrandra* Moench (= *Gentianella campestris* [L.] Borner), a European species.

KEY TO THE MEXICAN SPECIES

1. Calyx lobes linear lanceolate, lanceolate, or ovate lanceolate, 2-12 mm long, the sinuses acute to sharply rounded. .....(3)

1. Calyx lobes teethlike, 0.5-2.0 mm long, usually of a thicker texture than the tube, arising from a calyx tube with a relatively flat upper margin. .....(2)

2. Calyx split to the base along one side to form a membranaceous sheath. ..... *G. wislizeni*

2. Calyx a continuous tube, herbaceous in texture, not membranous. ..... *G. calycidon*

3. Calyx tube (1-)2-3 mm long, with lobes 3-12 mm long; corollas 10-18 mm long. .....(5)

3. Calyx tube 0.5-1.0 mm long, with lobes 2-4 mm long; corollas 6-11 mm long. .....(4)

4. Corollas without fimbriae, the tube 4.0-6.5 mm long; calyx lobes thin herbaceous, narrowly triangular; fruits sessile. . *G. microcalyx*

4. Corollas with numerous fimbriae, the tube 6-8 mm long; calyx lobes fleshy, linear; fruits stipitate. ..... *G. tarahumarae*

5. Calyx tube 2.0-3.5 mm long. .....(8)

5. Calyx tube 1-2 mm long. .....(6)

6. Corollas 17-20 mm long; apical extensions of fruit 1.2-1.8 mm long, narrowly oblong. ..... *G. glossocarpa*

6. Corollas 8-16 mm long; apical extensions of fruit 0.3-0.5 mm long, ovate. .....(7)

7. Calyx lobes 6-12 mm long, with minutely papillate margins; corollas 13-16 mm long, the tube 9-11 mm long, the lobes relatively even in length, with fimbriae inserted at the base of the lobes. ..... *G. amarella*

7. Calyx lobes 3-7 mm long, with smooth margins; corollas 8-14 mm long, the tube 4-8 mm long, the lobes strongly uneven in length, with fimbriae inserted at about midlength of the lobes. ..... *G. fimbrilinguis*

8. Calyx 5-11 mm long, the tube 2-3 mm long; corollas mostly bluish or purplish before drying, 10-18 mm long. .....(10)

8. Calyx (9-)12-15 mm long, the tube 3-4 mm long; corollas yellow before drying, 17-25 mm long. .....(9)

9. Corollas 20-25 mm long, the lobes 7-10 mm long, with attenuate apices, the throat densely fimbriate. ..... *G. wrightii*

9. Corollas 17-21 mm long, the lobes 5-7 mm long, with acute but not attenuate apices, the throat sparsely fimbriate. ..... *G. hartwegii*

10. Calyx lobes 4-8 mm long; corolla fimbriae inserted well above the base of the lobes. ..... *G. mexicana*

10. Calyx lobes 3-4 mm long; corolla fimbriae inserted at the base of the lobes. .....(11)

11. Pedicels and the veins, lamina, and margins of calyx lobes and tube densely scabrous with erect, prominent papillae. ..... *G. canosoi*

11. Pedicels smooth, the calyx sometimes with minutely papillate-scabrous margins, otherwise smooth. ..... *G. sandiana*

1. *Gentianella amarella* (L.) Borner subsp. *acuta* (Michx.) Gillett, Ann. Missouri Bot. Gard. 44:253. 1957. BASIONYM: *Gentiana acuta* Michx., *Fl. Bor. Amer.* 1:177. 1803. TYPE: [CANADA. Quebec.] Near "Tadoussack," *A. Michaux s.n.* (P). *Amarella acuta* (Michx.) Rafin., *Fl. Tellur.* 3:21. 1837. *Ericala acuta* (Michx.) G. Don, *Gen. Syst. Gard. Bot.* 4:190. 1837. *Gentiana amarella* L. var. *acuta* (Michx.) Herder, Trudy Imp. S-Peterburgsk. Bot. Sada 1:428. 1872. *Gentianella acuta* (Michx.) Hiit., Mem. Soc. Faun. Fl. Fenn. 25:76. 1950. *Gentiana amarella* L. subsp. *acuta* (Michx.) Hultén, Ark. Bot., ser. 2, 7:107. 1968. *Gentiana amarella* L. f. *michauxiana* Fern. (homotypic with *Gentiana acuta*), Rhodora 19:151. 1917. *Gentianella amarella* (L.) Borner f. *michauxiana* (Fern.) Scoggan, *Fl. Canada* 1:52. 1978.

Michaux's citation reads "in montibus altibus Carolinae et Canada, prope Tadoussack." The only species of *Gentianella* of the Appalachian Mountains in the "Carolina" region is *G. quinquefolia* (L.) Small. See Gillett (1957) for numerous other North American (north of México) synonyms of *Gentiana acuta.*

Leaves spreading-ascending, ovate-lanceolate, 3-5 nerved, 15-25 mm long. Pedicels 3-12 mm long. Calyx 7-13 mm long, the tube 1-2 mm long, the lobes 6-12 mm long, often strongly unequal in width, less so in length, herbaceous,

the margins distinctly papillate-thickened and commonly purplish. Corollas blue to purple, 13-16 mm long, the tube 9-11 mm long, the 5 lobes 4-5 mm long, lanceolate-ovate, erect, fimbriae numerous, inserted at the base of the corolla lobes. Staminal filaments slightly winged, adnate along the basal 1/4-1/3 of the corolla tube, anthers purplish. Fruits sessile, 12-15 mm long, not exceeding the corolla at maturity, the apices erect.

Disjunct populations in Durango and Nuevo León, widespread in the western United States, eastern to western Canada and north into Alaska, the Aleutian Islands, northeastern U.S.S.R.; in Nuevo León, meadows, openings in conifer forests, just below to above timberline, ca. 3400-3800 m, July-September; 2000-2100 m in Durango.

Additional collections examined: MÉXICO. Durango: Mpio. Pueblo Nuevo, 5 km NE of El Palmito, steep barranca wall, 19 Oct 1983, *Breedlove 58881* (MO); 21.9 mi NE of El Paraiso, Sinaloa, on road between Villa Union and El Salto, steep, moist embankment, 29 Sep 1953, *Ownbey & Ownbey 1984* (GH, US). Nuevo León: Cerro Potosí, 27 Aug 1987, *Bogler & Atkins 149* (TEX); Cerro Potosí, 21 Aug 1969, *Hinton, et al. 17244* (TEX); Cerro Potosí, 23 Aug 1984, *Lavin 4782* (TEX); Cerro Potosí, 26 Jul 1985, *McDonald 1783* (MO, TEX); Cerro Potosí, 21 Jul 1935, *Muller 2247* (GH, MO); Cerro Potosí, 1938, *Univ. Illinois Students 971* (MO, US).

Gillett (1957) treated these plants as a subspecies of *Gentianella amarella* (L.) Borner, while noting that the subsp. *amarella* is restricted to central and western Europe, completely disjunct from its North American relatives. Subsp. *amarella* and another more geographically restricted subspecies have been recognized in western Europe (Clapham, *et al.* 1987). In comparisons of the American and Eurasian populations of *G. amarella*, Fernald (1917) concluded that all were conspecific, but he did not identify the origin of the extra-American specimens he compared. Fernald (1950) and Gleason & Cronquist (1963) recognized the North American plants as *G. amarella*, but similar plants that extend into northeastern Russia were identified as *G. acuta* Michx. (Grossgeim 1952). Hultén (1968) identified the same taxon from Alaska as *Gentiana amarella* L. subsp. *acuta* (Michx.) Hultén.

Compared to the American plants of *Gentianella amarella*, the European ones tend to have larger corollas (12-22 mm long, Clapham, *et al.* 1987). In the northeastern U.S.S.R., they are 9-13 mm long (Grossgeim 1952) and 10-15 mm long in Alaska (Hultén 1968). Clearly, the taxonomy of this complex needs to be studied in detail from a worldwide perspective, where there perhaps is as much justification for treating subsp. *acuta* and subsp. *amarella* at the specific rank as combining them into a single species.

Disjunct populations of subsp. *acuta* occur in Durango and Nuevo León, apparently as southern extensions of montane population systems in California-Arizona and in New Mexico, respectively. I can find no basis for separating these Mexican plants from others in the southwestern United States. Besides

subsp. *acuta*, Gillett recognized four additional subspecies within *Gentianella amarella* in the New World. In his view, each of the other four American subspecies of *G. amarella* has a more restricted geographic range, each partially overlapping with the range of subsp. *acuta*. Marroquin & Rzedowski (1984) recognized two taxa in the Valley of México as subspecies of *G. amarella*, which are treated here as the separate species *G. mexicana* (Griseb.) Holub and *G. hartwegii* (Benth.) Holub. They noted that citations of subsp. *acuta* from the Valley of México refer to plants of *G. mexicana*; Gillett's report of subsp. *acuta* from the state of México was based on two collections of somewhat immature plants of *G. mexicana*. Previous records of subsp. *acuta* from Baja California are identified here as *G. fimbrilinguis* Nesom.

2. **Gentianella calycidon** Nesom, *sp. nov.* TYPE: MÉXICO. Chihuahua: 11 mi SW of El Vergel, 9200 ft, 7 Oct 1959, *D.S. Correll & H.S. Gentry 22895* (HOLOTYPE: GH!).

   Gentianellae sandianae (Gillett) Nesom similis sed differt lobis calycis dentoidibus multo brevioribusque marginibus rasilibus, corollis brevioribus, et antheris luteis differt.

Leaves ovate-lanceolate, 13-17 mm long, 5-9 mm wide, trinerved, spreading, with minutely papillate-scabrous margins. Pedicels 5-9 mm long, with flowers laterally oriented to slightly nodding. Calyx 4.0 mm long, the tube 2.5-3.0 mm long, the lobes 1.0-1.5 mm long, teethlike, linear-lanceolate and thickened relative to the tube, with smooth margins, the sinuses broadly rounded to nearly flat. Corollas pale lavender, drying yellowish, 15-18 mm long, the tube 10-12 mm long, the lobes ovate, not speckled, 4-5 mm long, fimbriae numerous, inserted at the very base of the corolla lobes. Staminal filaments broadly winged on the basal third, adnate to the basal 3-4 mm of the corolla tube, the anthers yellow. Fruits sessile, mature size not observed.

Known only from the type collection.

The calyx of *Gentianella calycidon* Nesom, with its flat margined tube and short, teethlike lobes with smooth margins, is very similar to that of *G. wislizeni* (Engelm.) Gillett, but the calyx is not as thin textured or cut to the base as in the latter. *Gentianella microcalyx* (Lemmon) Gillett has a calyx with short but scabrous margined lobes and much shorter tube, blue and shorter corollas, and no fimbriae in the corolla. *Gentianella calycidon* is different from *G. sandiana* (Gillett) Nesom in its fewer flowered inflorescence, shorter and differently textured calyx lobes without scabrous margins, shorter corollas, and yellow anthers.

3. *Gentianella canosoi* Nesom & Turner, Sida 14:227. 1990. TYPE: MÉXICO. Durango: Mpio. Pueblo Nuevo, vicinity of El Salto, pine woods, 4 Oct 1981, *S. González & S. Acevedo 2053* (HOLOTYPE: TEX!; Isotypes: GH!, MO!).

Stems often purple, the young portions densely papillate-scabrous, smooth below or remaining slightly scabrous along the ridges. Leaves subclasping, not basally connate, trinerved, lanceolate, 15-35 mm long, 3-6 mm wide, the margins minutely papillate-scabrous. Pedicels 1-4 mm long. Calyx prominently scabrous on the veins and lamina with long, erect papillae, most densely so on the veins, 5-6 mm long, the tube 2.0-2.5 mm long, the lobes linear-lanceolate, 3-4 mm long, equal in length or nearly so, spreading at the apices. Corollas yellow, drying yellow to purplish, 13-16 mm long, the tube 8-10 mm long, the 5 lobes spreading-erect, 5-6 mm long, with attenuate apices, fimbriae numerous, inserted at the base of the corolla lobes. Staminal filaments narrowly winged basally, adnate to the corolla tube for about half its length, anthers yellow. Fruits sessile, 14-18 mm long, distinctly exceeding the corollas.

South-central Durango; pine-oak woodlands, rich soil, ca. 2400-2650 m; September-November.

Additional specimens examined: MÉXICO. Durango: Sierra Madre W of Durango, Sep-Oct 1881, *Forrer s.n.* (US); Mpio. Pueblo Nuevo, 6 mi W of La Ciudad on Hwy 40, at Puerto de Buenos Aires, 7 Nov 1964, *Flyr 276* (TEX); Mpio. Pueblo Nuevo, 5 km SW of El Salto, 4 Oct 1981, *González & Acevedo 2033* (TEX); Mpio. Pueblo Nuevo, along Hwy 40 at the turnoff to La Campana, 3.2 mi W of Las Adjuntas and 14.7 mi W of El Salto, 26 Sep 1973, *Reveal 3458* (TEX).

4. **Gentianella fimbrilinguis** Nesom, *sp. nov.* TYPE: MÉXICO. Baja California Norte: Sierra San Pedro Martír, banks of La Sanca creek, 5 mi NW of La Grulla, 6700 ft, 17 Sep 1930, *I.L. Wiggins & D. Demaree 4845* (HOLOTYPE: GH!; Isotype: F).

Gentianellae amarellae (L.) Borner subsp. *acutae* (Michx.) Gillett similis sed differt lobis corollarum longis lanceolatisque in longitudine inaequalibus fimbriis ad ca. medio loborum insertis et filamentis antherarum ad basim tubi corollae insertis.

Plants 20-45 cm tall. Cauline leaves sharply ascending, ovate-lanceolate, not basally connate, 3-5 nerved, 15-40 mm long, the margins minutely papillate-scabrous. Pedicels 4-14 (-20) mm long. Calyx 4-8 mm long, the lobes smooth margined, 3-7 mm long, with sinuses acute to sharply rounded, the tube 1.0-1.5 mm long. Corollas purplish, 8-14 mm long, the tube 4-8 mm long, the 5 lobes lanceolate, erect, 4-6 mm long, often equaling or longer than the tube, usually very uneven in length, with one cut half the length of the corolla, each lobe bearing numerous fimbriae inserted in an arc at about midlength of the lobe. Staminal filaments not winged, inserted at the base of the corolla tube, anthers purple. Fruits short stipitate, 9-13 mm long, the apices erect to slightly divergent.

Baja California Norte, endemic to the Sierra San Pedro Martír; 2050-2350 m; September-October.

Additional collection examined: MÉXICO. Baja California Norte: Sierra San Pedro Martír, llanitos ca. 6 mi from La Encantada on trail to Vallecitos, 22 Sep 1938, *Wiggins 9075* (GH, US).

Both collections of this species were cited by Gillett (1957) as *Gentianella amarella* subsp. *acuta*, but they differ from the latter in the calyx tubes with smooth margins, anther filaments free to the base of the corolla tube, and shorter corollas with deeply cut, lanceolate corolla lobes of uneven length with fimbriae inserted at about the middle of the lobes. The fimbriae diverge from the corolla at about midpoint of the lobes and are adnate for a short distance below that. The corolla fimbriae of *G. mexicana* and *G. glossocarpa* Nesom are similarly positioned though not inserted so far distally.

5. **Gentianella glossocarpa** Nesom, *sp. nov.* TYPE: MÉXICO. Durango: Mpio. Mezquital, 48 km WNW of Huejuquilla El Alto, Jalisco, on road to Canoas, Durango; crest of ridge, forest of *Pinus*, *Arbutus*, and *Quercus*, with steep slopes to north and south, 2530 m, 21 Oct 1983, *D.E. Breedlove 59156* with F. Almeda (HOLOTYPE: MO!; Isotype: CAS).

   Gentianellae fimbrilingui Nesom similis tubis calycum brevibus, lobis calycum ad marginem laevibus, corollis caesiis, et lobis corollarum fimbriis supra basim insertis, sed foliis ad marginem laevibus, corollis longioribus, et fructibus longioribus extensionibus apicalibus linguiformibus 1.2-1.8 mm longis differt.

Plants 3-6 dm tall. Cauline leaves spreading-ascending, ovate-lanceolate, not basally connate, 3-5 nerved, 15-30 mm long, gradually reduced upwards, the margins smooth (not papillate). Pedicels 2-7 mm long. Calyx 5.5-7.0 mm long, the lobes smooth margined, 3.5-5.0 mm long, with acute to sharply rounded sinuses, the tube 2.0 mm long. Corollas "lavender," drying purplish blue, 17-20 mm long, the tube 11-12 mm long, the 5 lobes lanceolate, erect, 7-8 mm long, relatively even in length, each with numerous fimbriae inserted in an arc ca. 1 mm above the base. Staminal filaments not winged, inserted ca. 3 mm above the base of the tube; anthers purplish, not exserted from the corolla tube. Fruits 18-21 mm long, on a basal stipe ca. 2 mm long, the apices somewhat divergent, bearing persistent, narrowly oblong, tonguelike, apical extensions 1.2-1.8 mm long, these usually at least slightly recurved.

Known only from the type collection; the MO sheet bears three plants.

Gentianella glossocarpa Nesom is similar to *G. fimbrilinguis* Nesom in its short calyx tubes, calyx lobes with smooth margins, blue corollas, and corolla lobes with fimbriae inserted above the base but different in its smooth leaf margins, longer corollas, and longer fruits with long, tonguelike apical extensions. These latter structures (the persistent stigmatic portions of the ovary)

are found on *Gentianella* fruits of all species, but their shape and length on *G. glossocarpa* are distinct among the Mexican species. Further, the only other Mexican species with such long corollas and fruits are *G. hartwegii* and *G. wrightii* (A. Gray) Holub, which are closely related to each other but not especially close to *G. glossocarpa.*

6. *Gentianella hartwegii* (Benth.) Holub, Folia Geobot. Phytotax. 2:117. BASIONYM: *Gentiana hartwegii* Benth., *Pl. Hartw.* 47. 1840. TYPE: MÉXICO. Michoacán: Angangueo, [Aug-Sep 1838], *Hartweg 351* (probable HOLOTYPE: BM; Isotype: W, MO-photo!). *Gentiana mexicana* Griseb. subsp. *hartwegii* (Benth.) Wettst., Oesterr. Bot. Zeitsch. 50:291. 1900. *Amarella hartwegii* (Benth.) Arthur, Torreya 12:33. 1912. *Gentianella amarella* (L.) Borner subsp. *hartwegii* (Benth.) Gillett, Ann. Missouri Bot. Gard. 44:260. 1957.

   Gentiana mexicana subsp. *hartwegii* f. *pringlei* Wettst., Oesterr. Bot. Zeitsch. 50:291. 1900. TYPE: MÉXICO. México: Moist meadows, Nevado de Toluca, 11,000 ft, 6 Sep 1892, *C.G. Pringle 4237* (HOLOTYPE: WU; Isotypes: F, GH!, MO!, US!).

   Gentiana citrina Pollard, Proc. Biol. Soc. Washington 13:130. 1900. TYPE: MÉXICO. México: Wet meadows, valley of Toluca, 18 Aug 1892, *C.G. Pringle 4196* (HOLOTYPE: US; Isotypes: F, GH!, MEXU, MO!, NY).

Leaves ovate-lanceolate, spreading-ascending, 1.5-3.0 cm long, 7-12 mm wide, trinerved, basally rounded but not connate. Pedicels 5-25 mm long. Calyx 10-15 mm long, thin herbaceous, often with noticeable reticulate venation, the tube 3.5-5.0 mm long, the (4-) 5 lobes 5-10 mm long, slightly uneven in width. Corollas yellowish or creamy white, drying yellow, 17-21 mm long, the tube 11-16 mm long, the (4-) 5 lobes lanceolate ovate to lanceolate, 5-7 mm long, the apices acute to rounded, fimbriae relatively few though prominent, inserted at the base of the corolla lobes or slightly above. Staminal filaments narrowly winged near the base, adnate to the lower 3-4 mm of the corolla tube. Fruit sessile, 20-23 mm long, the apices erect to slightly divergent.

Michoacán, México, Distrito Federal; wet meadows, 2800-3400 m; July-October (-February).

Additional collections examined: MÉXICO. Distrito Federal: Near Dinamo de Contreras, 8 Aug 1965, *Rzedowski 20397* (TEX). México: Dist. Temascaltepec, Crucero-Agua Blanca, 8 Oct 1935, *Hinton 8320* (GH, US); Dist. Temascaltepec, Meson Viejo, 8 Feb 1932, *Hinton 1317* (GH, US); Dist. Temascaltepec, 9 mi E of Villa Victoria by Mex 15, 29 Jul 1965, *Kral 25169* (US).

Gentianella hartwegii and *G. wrightii* both produce flowers on relatively short pedicels, large and somewhat foliaceous calyx lobes, and large yellow

corollas, and they appear to be very closely related although distantly separated geographically. The latter differs chiefly in its slightly longer pedicels, smaller corollas with fewer fimbriae, and its smaller (on average) leaves.

7. *Gentianella mexicana* (Griseb.) Holub, Folia Geobot. Phytotax. 2:117. BASIONYM: *Gentiana mexicana* Griseb., *Gen. Sp. Gentian.* 243. 1839. TYPE: MÉXICO. "Patria," no other data, *Schiede s.n.* (GOET, not seen). *Gentianella amarella* subsp. *mexicana* (Griseb.) Gillett, Ann. Missouri Bot. Gard. 44:258. 1957. *Amarella mexicana* (Griseb.) Arthur, Torreya 12:34. 1912.

Leaves spreading-ascending, ovate-lanceolate, trinerved, (6-) 10-25 mm long, 5-9 mm wide. Pedicels 3-14 mm long. Calyx 6-11 mm long, the tube 2.0-3.5 mm long, the lobes narrowly lanceolate, 4-8 mm long, often strongly unequal in width, less so in length, herbaceous, the margins minutely papillate-scabrous. Corollas bluish to purple, 10-18 mm long, the tube 6-9 (-14) mm long, the lobes 3.5-5.0 mm long, ovate-lanceolate, erect, fimbriae numerous, inserted in an arc at about midlength of the corolla lobes or slightly below. Staminal filaments very slightly winged, adnate to the basal 2-4 mm of the corolla tube, anthers greenish. Fruits sessile, 8-15 mm long, shorter than the corollas, the apices erect.

Veracruz, Hidalgo, Distrito Federal, México, Oaxaca; open meadows, sometimes near timberline, areas of pine to fir woods, 2350-3200 m; September-November (-December).

Additional collections examined: MÉXICO. Without locality, *Ehrenberg 79* (GH). Distrito Federal: La Cima, 14 Oct 1908, *Barnes & Land 383* (US); Desierto Vieja, Vallee de México, 17 Oct 1865-1866, *Bourgeau 1125* (GH); Cañada Contreras, Sep 1937, *Lyonnet 1978* (US); Desierto de los Leones, Sep 1929, *Lyonnet 517* (GH, MO, US); S of Contreras, 17 Sep 1930, *Russell & Souviron 197* (US). Hidalgo: Pachuca, 28 Oct 1900, *Holway 5253* (GH); Mpio. Mineral del Chico, below national park, fir forest, 20 Oct 1946, *Moore 1607* (GH). Mexico: Toluca, Oct 1827, *Berlandier 1086* (MO-photo of G specimen); Dist. Temascaltepec, Crucero, 21 Oct 1932, *Hinton 2117* (GH, US); Dist. Temascaltepec, Crucero-Agua Blanca, 9 Oct 1935, *Hinton 8330* (GH, MO, TEX, US); Dist. Temascaltepec, Sierrita, 29 Oct 1935, *Hinton 8313* (GH, MO, TEX, US); Dist. Temascaltepec, Oro, 28 Sep 1952, *Matuda 27261* (MO); Dist. Temascaltepec, road to Nevado de Toluca, 4 Oct 1940, *Moore 89a* (GH); Dist. Temascaltepec, Sierra de las Cruces, 2 Oct 1892, *Pringle 4227* (GH, MO, US); Dist. Temascaltepec, Ixtaccihuatl, Oct 1905, *Purpus 1757* (GH, MO, US); Dist. Temascaltepec, Cerro San Miguel, Nov 1912, *Salazar s.n.* (US). Oaxaca: Sierra de Clavellinas, 26 Oct 1894, *Smith 667* (MO, US). Veracruz: Cofre de Perote, La Simiento, 9 Dec 1930, *Balls 5435* (US); Mpio. Las Vigas, Manzanares, 20 Oct 1972, *Ventura A. 7222* (LL).

These plants are different from *Gentianella amarella* subsp. *acuta* in the distinctive epilobed insertion of the corolla fimbriae, longer calyx tube, and narrower leaves. The only other species in south-central México, *G. hartwegii*, has much more foliaceous calyx lobes without scabrous margins and longer, yellow corollas with fimbriae inserted at the bases of the lobes.

8. *Gentianella microcalyx* (Lemmon) Gillett, Ann. Missouri Bot. Gard. 44:246. 1957. BASIONYM: *Gentiana microcalyx* Lemmon, Pacific Rural Press 23:129. [Feb] 1882. TYPE: UNITED STATES. Arizona: [Cochise Co.], peaks of Chiricahua Mts., 30 Sep 1881, *J.G. Lemmon 584* (HOLOTYPE: CAS?; Isotypes: GH!, MO, US). *Gentiana microcalyx* Engelm. *ex* A. Gray, Proc. Amer. Acad. Arts 17:222. 1882. Homotypic with *Gentiana microcalyx* Lemmon but published separately and slightly later, based on *Lemmon 584* (HOLOTYPE: GH!; Isotypes: MO, US).

Leaves ovate, 1.5-3.5 cm long, 6-15 mm wide, not basally connate. Pedicels 10-25 mm long. Calyx 2.5-4.5 mm long, the tube 0.5-1.0 mm long, the lobes thin herbaceous, 2.0-3.5 mm long, usually noticeably unequal, the margins smooth edged. Corollas lavender-pink to bluish, often drying yellowish, sometimes slightly speckled, completely lacking fimbriae, (6-) 7-10 mm long, the tube 4.0-6.5 mm long, the 5 lobes 2.0-3.5 mm long, ovate-lanceolate, erect. Staminal filaments slightly winged, adnate to the basal 2 mm of the corolla tube, anthers greenish to purplish, sometimes abortive. Fruits 8-9 mm long, on short (1 mm) stipes, the apices widely divergent.

Sonora, Chihuahua, Coahuila, Durango, southern Arizona; commonly on seepy ledges or cliffs, in areas of oak-pine to pine and pine-fir woodlands, 1800-2650 m; August-October.

Additional collections examined: MÉXICO. Chihuahua: N of Basiguare, a few mi off Creel-Río Urique road, 19 Oct 1977, *Bye & Weber 8334* (GH); Mpio. Temosachi, Nabogame, 3 Dec 1987, *Laferriere 1285* (TEX); Temosachic, Madera, *Muller 3465* (GH, as cited by Gillett 1957). Coahuila: Sierra de la Madera, middle and upper Cañon de la Hacienda, 21 Sep 1972, *Chiang, et al. 9451* (LL); Sierra de la Madera, above Cañon de la Hacienda, 5 Aug 1973, *Henrickson 11945* (TEX); Sierra de la Madera, Corte Blanco fork of Charretera Canyon, 12-14 Sep 1941, *Johnston 8990* (GH); Sierra de la Madera, high crest of main ridge ca. 2 km E of Picacho de Zozaya, 13 Sep 1941, *Johnston 9030* (GH, LL); Sierra de la Madera, Cañon Desiderio, 29 Sep 1976, *Wendt 1831* (TEX). Sonora: 4 mi E of El Bilito, Río Bavispe region, 12 Oct 1941, *White 4771* (US). Durango: Barranca, Sandia Station, *Pringle 13660* (GH, as cited by Gillett 1957).

Gentianella microcalyx is recognized by its very short calyx tube, consistent lack of corolla fimbriae, and fruits with widely divergent apices. It is most similar to and probably most closely related to *G. tarahumarae* Nesom,

distinguished by features noted in the key. As cited above, two specimens of *Gentianella microcalyx* (*Mueller 3465*, *Pringle 13660*) that were examined by Gillett have not been relocated in the present study.

9. **Gentianella sandiana** (Gillett) Nesom, *comb. et stat. nov.* BASIONYM: *Gentianella amarella* subsp. *sandiana* Gillett, Ann. Missouri Bot. Gard. 44:259. 1957. TYPE: MÉXICO. Durango: Mesa de Sandia, 9000 ft, 20 Oct 1905, *C.G. Pringle 10111* (HOLOTYPE: MO!; Isotypes: F, GH!, MEXU, NY, US!).

Leaves ovate-lanceolate, basally rounded, trinerved, 15-30 mm long, 6-10 mm wide, spreading-ascending. Pedicels 3-9 mm long. Calyx 5.5-7.0 mm long, the tube 2.5-3.0 mm long, with linear lobes 3.0-4.0 mm long, not fleshy, the margins and veins minutely but prominently papillate-scabrous. Corollas light bluish to lavender, drying yellowish, sometimes with red speckles, 11-16 mm long, the tube 7-10 mm long, the lobes 3.5-6.0 mm long, spreading, ovate lanceolate to obovate, fimbriae numerous, inserted at the very base of the corolla lobes. Staminal filaments very narrowly winged, adnate to the basal 3-4 mm along the corolla tube, anthers greenish. Fruits 13-18 mm long, slightly longer than the corolla tube, sessile.

Northern Durango and southern Chihuahua; 9000-9200 ft; October.

Additional collection examined: MÉXICO. Chihuahua: 11 mi SW of El Vergel, 9200 ft, 7 Oct 1959, *Correll & Gentry 22895* (GH).

Gentianella sandiana (Gillett) Nesom is similar to *G. canosoi* Nesom & Turner in the sizes and relative proportions of its calyces and corollas. The latter differs in its densely papillate-scabrous calyx and pedicels, and its yellow anthers.

The tiny red "speckles" on the corolla lobes, noted by Gillett (1957) as distinctive of this species, are found on 5 of the 7 plants mounted on the three type sheets examined. They also occur on the corollas of some, but not all, plants of both *Gentianella tarahumarae* and *G. microcalyx* but not on corollas of *G. canosoi*.

10. **Gentianella tarahumarae** Nesom, *sp. nov.* TYPE: MÉXICO. Chihuahua: Mpio. Guachochic, between Cusarare and Bahichic, open slopes of mixed pine and oak forest, 6900 ft, 10 Oct 1974, *R. Bye 7045* (HOLOTYPE: TEX!).

Differt a *Gentianella amarella* (L.) Borner subsp. *acuta* (Michx.) Gillett foliis effusis crassis anguste lanceolatis minoribusque, calycibus brevioribus lobis incrassatis linearibusque, corollis brevioribus, et ovariis stipitatis.

Leaves darkly pigmented, linear lanceolate to lanceolate, sometimes noticeably trinerved, not at all basally rounded, 1-3 cm long, 1.5-5.0 mm wide, strongly spreading to slightly deflexed. Pedicels 3-9 mm long. Calyx 2.2-5.0 mm long, 1/6-2/5 as long as the corolla, the tube 0.5-1.0 mm long, with fleshy, linear lobes 1.8-4.0 mm long, with sinuses acute to sharply rounded, the margins minutely papillate-scabrous. Corollas purple to blue, drying whitish to blue or rose, 8.5-11. mm long, the tube 6-8 mm long, the 5 lobes ovate to ovate elliptic, spreading, 2.5-3.0 mm long, sometimes speckled, with numerous fimbriae inserted at the base of the lobes. Staminal filaments inserted the middle of the corolla tube, not winged, the anthers greenish, included within the corolla tube. Fruits 10-12 mm long, with erect to somewhat divergent apices, slightly exserted from the corolla tube, on a short (0.5-0.9 mm long) but distinct stipe.

Southwestern to south-central Chihuahua; 2000-2200 m; September-November.

Additional collections examined: MÉXICO. Chihuahua: Mpio. Guachochic, Cusarare, along arroyo just NW of Cusarare church, 2200 m, 14 Oct 1977, *Bye & Weber 8095* (GH); Sierra Madre, 65 mi E of Batopilas, 7000 ft, 1-2 Oct 1898, *Goldman 188* (US); SW Chihuahua, Aug-Nov 1885, *Palmer 334* (GH-mounted on same sheet as isotype of *G. wislizeni*, US).

The collections by Goldman and Palmer were identified by Gillett as *Gentianella sandiana*, but that taxon differs from *G. tarahumarae* in its ovate-lanceolate, ascending leaves, calyces with a much longer tube and broader lobes, longer corollas, and sessile ovaries. *Gentianella tarahumarae* is distinct from *G. amarella* subsp. *acuta* in its thick, short, narrowly lanceolate, spreading leaves, shorter calyces with thickened, linear lobes, shorter corollas, and stipitate ovaries. As noted by Bye on the label of the type collection of *G. tarahumarae*, this is "one of the few plants still in flower after frost; plants mashed in water and used to wash head and clothes."

11. *Gentianella wislizeni* (Engelm.) Gillett, Ann. Missouri Bot. Gard. 44:235. 1957. BASIONYM: *Gentiana wislizeni* Engelm., Trans. Acad. Sci. St. Louis 2:215. 1862. TYPE: MÉXICO. Chihuahua: Llanos, mountains west of Chihuahua, 5 Oct 1846, *Wislizenus 206* (HOLOTYPE: MO!; Isotype: GH!).

Leaves ovate-lanceolate with rounded bases, not basally connate, trinerved, 2-4 cm long, 4-15 mm wide, spreading at right angles to somewhat ascending. Pedicels 4-18 mm long. Calyx tube thin textured, often hyaline, commonly purplish, 3.5-4.0 mm long, nearly flat across the top, with 5, greenish, linear toothlike lobes 0.5-1.5 mm long, the whole tube split to the base along one side to form a membranaceous sheath. Corollas whitish pink to violet purple, commonly drying distinctly yellowish, 8-14 mm long, the 5 lobes lanceolate

ovate to broadly elliptic, spreading to erect, 3-4 mm long, of even length, fimbriae relatively dense to very sparse, inserted at the base of the lobes, sometimes completely lacking. Staminal filaments narrowly winged, adnate to the basal half of the corolla tube, the anthers wholly included to slightly exserted from the corolla tube. Fruit 10-12 mm long, sessile, with erect apices.

Chihuahua, Durango, Arizona; rocky sites in pine-oak and pine woodlands, 2000-2550 m; September-October.

Additional collections examined: MÉXICO. Chihuahua: Mex. NW R[ail] R[oad], continental divide, ridge between Río Chico and Río Caballo, 30 Sep 1911, *Barlow s.n.* (US); Santo Domingo on Matachic-Ocampo truck road between Concheno and Pinos Altos, 21 Oct 1945, *Hewitt 78* (GH); Mesa, W of Hop Valley, 17 Sep 1903, *Jones s.n.* (US); 5.3 mi W of Madera on road to Río Papigochic, 22 Sep 1984, *Lavin 4947* (TEX); Colonia Garcia, 23 Sep 1934, *Pennell 19097* (GH, US); Colonia Garcia, near First Meadow, 23 Sep 1934, *Pennell 19136* (GH, US); Sierra Madre, cool slopes, *Pringle 1328* (GH, US); Sierra Madre, cool slopes, 9 Oct 1888, *Pringle 1662* (MO); near Colonia Garcia, 11 Sep 1899, *Townsend & Barber 322* (GH, MO, US); 8 mi S of Cd. Guerrero, ca. 2 mi W of Río Colorado, 23 Sep 1981, *Warnock 2358* (TEX). Durango: Road between San Julian and Cerro Prieto, 9 Sep 1898, *Nelson 4950* (US).

The peculiar calyx of this species is unmistakable. The closest relative of *Gentianella wislizeni* probably is *G. calycidon*, as noted in the discussion following the latter.

12. *Gentianella wrightii* (A. Gray) Holub, Folia Geobot. Phytotax. 2:118. BASIONYM: *Gentiana wrightii* A. Gray, *Syn. Fl. N. Amer.* 2(2):118. 1886. TYPE: MÉXICO. Sonora: Valley near Santa Cruz, springy ground, 24 Sep 1851, *C. Wright 1659* (HOLOTYPE: GH!; Isotype: GH!). *Amarella wrightii* (A. Gray) E. Greene, Leafl. Bot. Observ. Crit. 1:53. 1904. *Gentianella amarella* (L.) Borner subsp. *wrightii* (A. Gray) Gillett, Ann. Missouri Bot. Gard. 44:259. 1957.

Amarella cobrensis E. Greene, Leafl. Bot. Observ. Crit. 1:56. 1904. LECTOTYPE (designated here): UNITED STATES. New Mexico: Santa Rita del Cobre, 11 Oct 1880, *E.L. Greene s.n.* (ND-G!).

Apparently referring to the type, Gillett (1957) cited a collection by Greene (*s.n.*) from the "Pinos Altos Mountains" in Grant Co., New Mexico, but the specimens referred to in the original publication apparently are from a different gathering. The specimen chosen as lectotype is a sheet from Greene's herbarium, filed by Greene in his *Gentiana cobrensis* folder. The specimen has label data exactly matching those in the

publication, although it has no original identification or annotation other than "*Gentiana Amarella* L. var."

Gentiana townsendii Briq., Candollea 4:329. 1931. TYPE: MÉXICO. Chihuahua: Near Colonia Garcia, 1 Oct 1899, *C.H.T. Townsend & C.M. Barber 358* (HOLOTYPE: G; Isotypes: F, GH!, MO!, NY, US!).

Leaves ovate-lanceolate, spreading to ascending, 2-5 cm long, 8-17 mm wide, trinerved, basally rounded but not connate. Pedicels 3-5 (-15) mm long. Calyx 8-13 mm long, thin herbaceous, often with noticeable reticulate venation, the tube 3.5-5.0 mm long, the 5 lobes 6-8 mm long, slightly uneven in width. Corollas yellowish or whitish, rarely with blue streaks, drying yellow, 20-25 mm long, the tube 13-16 mm long, the lobes lanceolate, 7-10 mm long, with markedly attenuate apices, fimbriae numerous, inserted at the base of the corolla lobes or slightly above. Staminal filaments narrowly winged near the base, adnate to the lower 3-5 mm of the corolla tube. Fruit sessile, 22-26 mm long, the apices erect to slightly divergent.

Sonora, Chihuahua, Sinaloa, Arizona, New Mexico; low, wet meadows or swales, area of pine-juniper to pine woodlands, 2100-2400 m; August-November.

Additional collections examined: MÉXICO. Chihuahua: SW of Creel, Mpio. Bocoyna, 17 Oct 1977, *Bye & Weber 8262* (GH); 1-2 mi S of Creel, 25 Sep 1972, *Henrickson 8031* (TEX); Chuichupa, 26 Sep 1903, *Jones s.n.* (MO, US); SW Chihuahua, Yerba Buena, Nov 1885, *Palmer 306* (GH, MO, US); Colonia Garcia, 23 Sep 1934, *Pennell 19118* (US). Sinaloa: Cerro del Viejo, San Ignacio, 19 Nov 1917, *Montes & Salazar 83* (US).

See comments following *Gentianella hartwegii*, which is closely related.

ACKNOWLEDGMENTS

I thank Dr. B.L. Turner, Dr. D.R. Windler, and Dr. A. McDonald for their review and comments, Dr. Barney Lipscomb for help with obtaining pertinent literature, Dr. Barbara Hellenthal (Curator of ND-G) for help in interpretation of the specimen of *Gentianella cobrensis*, and GH, MO, ND-G, and US for loans of specimens.

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Phytologia (January 1991) 70(1):21-23.

NAMA QUIEXOBRANUM (HYDROPHYLLACEAE): A NEW SPECIES FROM OAXACA, MÉXICO

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ABSTRACT

Nama quiexobranum *sp. nov.* is known only from Cerro Quiexobra in the Sierra Madre del Sur, Oaxaca. In several aspects, *N. quiexobranum* approaches *N. sericeum* Willd. *ex* Roem. & Schult. and *N. origanifolium* H.B.K., but its seeds are most similar to those of the primitive species, *N. hirsutum* Mart. & Gal. and *N. prostratum* Brand. *Nama quiexobranum* appears to link the derived *N. sericeum, N. origanifolium,* and several annual species to these basal taxa.

KEY WORDS: *Nama*, Hydrophyllaceae, México

Nama quiexobranum Bacon & McDonald, *sp. nov.*

N. sericeo Willd. *ex* Roem. & Schult. caulibus fragilibus cymis laxis terminalibus ac lateralibus, corollis infundibuliformis ac obconicis usque ad 22 mm longis tangit, sed foliis angustioribus usque ad 7 mm latis sine trichomatibus densis sericeis in pagina inferiore, seminibus corrugatis costis minutis longitudinalibus 0.8-1.1 mm longis differt.

TYPE: MÉXICO. Oaxaca: 35 km ESE of Miahuatlán, 5 km NE of Santo Domingo Ozolotepec, Cerro Quiexobra, 16° 10′ N Lat., 96° 15′ W Long., 3650-3800 m. Timberline vegetation along ridges and in mountain "saddles," dominated below by pine forest, occasional on upper margins of rock outcrops or less commonly in damp, shaded ravines, soft wooded perennials, flowers dark blue-purple, 4 Oct 1990, *McDonald 3014* (HOLOTYPE: TEX!; Isotypes: GH!, MEXU!, NY!, US!).

Erect, mealy-glandular perennials to 40 cm tall, the brittle stems branching above their base, moderately to densely puberulous tomentose, or bearing scattered, hirsute-hispid trichomes to 1 mm long. Leaves 10-28 mm long, 1.5-7.0 mm broad, oblong, elliptic, oblanceolate, or obovate, plane, or the younger weakly to strongly revolute, acute to rounded at apex, attenuate and sessile or with a distinct petiole 1.0-3.5 mm long, invested with moderate to dense, appressed, short, strigillose trichomes. Flowers in loose, terminal or lateral, racemoid cymes; peduncles and pedicels slender, (1.7-) 4.5-18.0 (-34.0) mm long; sepals 6.0-11.5 mm long, broadly linear to spatulate, acute to rounded apically, and moderately hispid-hirsute; corollas 18-22 mm long, broadly tubular-obconic, dark blue-purple; filaments 11.0-12.8 mm long, the free portions distally terete but soon becoming somewhat flattened and expanded some distance above their insertion 5.0-6.3 mm above corolla base, about twice as long as the prominently winged adnate portions; mature styles 6.4-8.2 mm long. Capsules 6.8-7.4 mm long, 2.8-4.4 mm broad, ovoid to ellipsoid; seeds 0.8-1.1 mm long, multifaceted, rarely somewhat ovoid, brown, with weak transverse corrugations and longitudinal ridges. Chromosome number, $n = 7$ pairs.

Nama quiexobranum Bacon & McDonald is an interesting taxon in that it combines features found in a number of species of *Nama*. Its obconic-broadly tubular corollas, often exceeding 20 mm in length, and loose, terminal inflorescences are similar to those of *N. sericeum* Willd. *ex* Roem. & Schult.; it also has the unusual brittle stems found in both *N. sericeum* and *N. origanifolium* H.B.K. The latter two species are Mexican perennials distributed to the north of the state of Oaxaca. All three species are readily differentiated, however, by leaf shape, size, and pubescence or flower size. *Nama origanifolium* differs from *N. quiexobranum* by corollas 4.5-7.5 mm long, its usually velvety-villous indument, and smaller, black seeds 0.3-0.5 mm long. *Nama sericeum* is distinguished by broader leaves (7.0-22.0 mm wide), densely sericeous leaf undersurfaces, and weakly reticulate, smaller seeds (0.6-0.8 mm long).

Seeds of *Nama quiexobranum* and *N. hirsutum* Mart. & Gal. (a perennial found in southern México and northern Guatemala), are strikingly similar in their size (0.8-1.1 mm long), shape, and texture, exhibiting weak transverse corrugations and longitudinal ridges. In addition, wall thickenings in cells of the outermost testa of both species are essentially alike; columnar, often basally branched, generally extending from the radial wall into and across the lower transverse wall that forms the floor of the cell. In wall thickening patterns, seeds of *N. quiexobranum* and *N. hirsutum* are much like those of *N. prostratum* Brand, another perennial distributed in central and southern México. Based on seed features, both *N. hirsutum* and *N. prostratum* were suggested by Chance & Bacon (1984) to be primitive elements in *Nama*. Thus, similarities of seed features among these taxa suggest that *N. quiexobranum* represents yet another basal member in the genus. At the same time, morphological

similarities among *N. quiexobranum*, *N. sericeum*, and *N. origanifolium* argue that the latter two species are to be positioned near the former. As Chance & Bacon (1984) allied *N. sericeum* and *N. origanifolium* with several annual species found in México and southwestern United States (see Bacon 1987), *N. quiexobranum* appears to link these derived species with basal elements in the genus.

ACKNOWLEDGMENTS

We thank Dr. Guy Nesom and Dr. B.L. Turner for critically reviewing the manuscript.

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Phytologia (January 1991) 70(1):24-27.

A CLASSIFICATION OF THE RANUNCULACEAE WITH SPECIAL REFERENCE TO THE WESTERN HEMISPHERE

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ABSTRACT

A classification of the Ranunculaceae of the Western Hemisphere is presented as consisting of three subfamilies, 16 tribes, two subtribes, 30 genera, and an estimated 437 species. Two tribes (**Eranthideae**, **Xanthorhizeae**) are described as new, and six taxa are given a new tribal status (**Adonideae**, **Aquilegieae**, **Coptideae**, **Thalictreae**, **Trautvetterieae**, **Trollieae**).

KEY WORDS: Ranunculaceae, classification, nomenclature, taxonomy, Western Hemisphere

The following classification of Ranunculaceae portrays a subfamilial, tribal, and subtribal classification of the 30 genera of Ranunculaceae native or naturalized within the Western Hemisphere. Other genera will be noted and included in a subsequent and more detailed paper. In the classification proposed here, Ranunculaceae consists of three subfamilies, which are classified further into tribes, and in one case, subtribes. Data and cladistic analyses that support the classification system adopted here will be published elsewhere. Every attempt has been made to secure the oldest correct name for each taxon recognized. The authors will be grateful if any errors of omission or citation are called to their attention. The numbers of species, in some cases estimated, are given within parentheses following the reference to the protologue of each genus. We estimate there are 437 species of Ranunculaceae within the Western Hemisphere.

RANUNCULACEAE A.L. de Jussieu, *Gen. pl.* 321. 1789. Crowfoot Family.

Subfam. I. Hydrastidoideae Engler & Gilg, *Syllabus*, ed. 7. 188. 1912.

1. *Hydrastis* L., *Syst. nat.*, ed. 10, 2:1069, 1088, 1374. 1759. (1). Golden seal, Orangeroot.

Subfam. II. Ranunculoideae

Tribe 1. Ranunculeae

2. *Ranunculus* L., *Sp. pl.* 1:548. 1753. *Gen. pl.*, ed. 5. 243. 1754. (141). Buttercup, Crowfoot.
3. *Krapfia* D.C., *Syst. nat.* 1:228. 1818. (8).
4. *Myosurus* L., *Sp. pl.* 1:284. 1753. *Gen. pl.*, ed. 5. 137. 1754. (5). Mouse-tail.
5. *Hamadryas* Commerson *ex* de Jussieu, *Gen. pl.* 232. 1789. (5).
6. *Laccopetalum* Ulbrich, Bot. Jahrb. Syst. 37:404-408. 1906. (1).

Tribe 2. **Trautvetterieae** (Tamura) Duncan & Keener, *stat. nov.* BASIONYM: Trautvetteriinae Tamura, Sci. Rep. Osaka Univ. 16:42. 1967.

7. *Trautvetteria* Fischer & Meyer, Index sem. hort. petrop. 1:22. 1835. (1). False-bugbane.
8. *Kumlienia* E. Greene, Bull. California Acad. Sci. 1:337. 1886. (2).

Tribe 3. Anemoneae DC., *Syst. nat.* 1:129. 1818.

Subtribe 1. Anemoninae Spach, *Hist. nat. vég.* 7:190. 1839.

9. *Anemone* L., *Sp. pl.* 1:538. 1753. *Gen. pl.*, ed. 5. 241. 1754. (36). Anemone.
10. *Hepatica* P. Miller, *Gard. Dict.*, abr. ed. 4. 1754. (1). Hepatica, Liverleaf.
11. *Pulsatilla* P. Miller, *Gard. Dict.*, abr. ed. 4. 1754. (2). Pasqueflower, Prairie-smoke.
12. *Barneoudia* Gay, *Fl. chil.* 1:19. 1845. (3).
13. *Oreithales* Schlechtendal, Linnaea 27:559-560. 1954. (1).

Subtribe 2. Clematidinae Lotsy, Vortr. bot. Stammesgesch. 3:584. 1911.

14. *Clematis* L., *Sp. pl.* 1:543. 1753. *Gen. pl.*, ed. 5. 242. 1754. (47). Clematis.

Tribe 4. Helleboreae DC., *Syst. nat.* 1:130, 306. 1818.

15. *Helleborus* L., *Sp. pl.* 1:557. 1753. *Gen. pl.*, ed. 5. 244. 1754. (2). Hellebore.

Tribe 5. Cimicifugeae Torrey & A. Gray, *Fl. N. Amer.* 1:34. 1838.

16. *Cimicifuga* Wernischeck, *Gen. pl.* 298, 321. 1763. (6). Bugbane.

17. *Actaea* L., *Sp. pl.* 1:504. 1753. *Gen. pl.*, ed. 5. 222. 1754. (3). Baneberry.

Tribe 6. **Eranthideae** Duncan & Keener, *tribus novum.*

Diagnosis: Herbae pumilae rhizomatibus tuberosis; folia palmata; folia rosulae petiolata; folia caulis sessilia verticillata; flores solitarii sessiles; sepala lutea grandia persistentia; petala peltata bilabiata nectarifera; stamina numerosa (18-44); folliculi stipitati. Typus genus: *Eranthis* Salisbury.

Dwarf herbs with tuberous rhizomes; leaves palmately divided; basal leaves petiolate; cauline leaves sessile, whorled; flowers solitary, sessile; sepals yellow, large, persistent; petals peltate, 2 lipped, nectariferous; stamens numerous (18-44); follicles stipitate. One genus, *Eranthis* Salisbury, native to the Mediterranean region.

18. *Eranthis* Salisbury, Trans. Linn. Soc. 8:303. 1807. (1). Winter-aconite.

Tribe 7. Nigelleae Schrödinger, Abh. K. K. Zool.-Bot. Ges. Wien 4, Heft 5, p. 58. 1909.

19. *Nigella* L., *Sp. pl.* 1:534. 1753. *Gen. pl.*, ed. 5. 238. 1754. (1). Love-in-a-mist.

Tribe 8. **Adonideae** (Spach) Duncan & Keener, *stat. nov.* BASIONYM: Adonidinae Spach, *Hist. nat. vég.* 7:222. 1839.

20. *Adonis* L., *Sp. pl.* 1:547. 1753. *Gen. pl.*, ed. 5. 242. 1754. (3). Pheasants-eye.

Tribe 9. Caltheae J.S. Presl *in* K.B. Presl, *Fl. sicul.* 1:20. 1826.

21. *Caltha* L., *Sp. pl.* 1:558. 1753. *Gen. pl.*, ed. 5. 244. 1754. (7). Marsh-marigold.

Tribe 10. **Trollieae** (Heintze) Duncan & Keener, *stat. nov.* BASIONYM: Trolliinae Heintze, *Cormofyternas fylogeni* 103. 1927.

22. *Trollius* L., *Sp. pl.* 1:556. 1753. *Gen. pl.*, ed. 5. 243. 1754. (2). Globe-flower.

Tribe 11. Delphinieae Schrödinger, Abh. K. K. Zool.-Bot. Ges. Wien 4, Heft 5, p. 58. 1909.

23. *Aconitum* L., *Sp. pl.* 1:432. 1753. *Gen. pl.*, ed. 5. 236. 1754. (13). Monkshood, Wolfsbane.

24. *Delphinium* L., *Sp. pl.* 1:530. 1753. *Gen. pl.*, ed. 5. 236. 1754. (73). Delphinium, Larkspur.

25. *Consolida* (DC., *Syst. nat.* 1:341. 1818) S.F. Gray, *Nat. arr. Brit. pl.* 2:711. 1821. (3). Garden Larkspur.

Subfam. III. Isopyroideae Schrödinger, Abh. K. K. Zool.-Bot. Ges. Wien 4, Heft 5, p. 59. 1909.

Tribe 12. **Coptideae** (Tamura) Duncan & Keener, *stat. nov.* BASIONYM: Coptidoideae Tamura, Sci. Rep. Osaka Univ. 17:52. 1968.

26. *Coptis* Salisbury, Trans. Linn. Soc. 8:305. 1807. (4). Goldthread.

Tribe 13. **Xanthorhizeae** Duncan & Keener, *tribus novum.*

Diagnosis: Fruticuli ligno noninduratis; radices lutae; folia pinnata nitida; foliola acute fissa vel incisa vel serrata; inflorescentiae paniculatae cernuae; flores parvi; sepala 5; petala 5; integumenta 2 integumento interiore quam integumento exteriore longiore; folliculi monospermi (ovulo unico obortivo). Typus genus: *Xanthorhiza* Marshall.

Shrublets with wood not becoming hard; roots yellow; leaves pinnate, shiny; leaflets sharply cleft, incised, or serrate; inflorescences paniculate, drooping; flowers small; sepals 5; petals 5; integuments 2, the inner integument longer than the outer; follicles one seeded (one ovule aborts). One genus, *Xanthorhiza* Marshall, native to southeastern United States.

27. *Xanthorhiza* Marshall, *Arbust. amer.* 167. 1785. (1). Yellow Root.

Tribe 14. Isopyreae Schrödinger, Abh. K. K. Zool.-Bot. Ges. Wien 4, Heft 5, p. 59. 1909.

28. *Enemion* Rafinesque, Jour. Phys. 91:70. 1820. (5). False Rue Anemone.

Tribe 15. **Aquilegieae** (Tamura) Duncan & Keener, *stat. nov.* BASIONYM: Aquilegiinae Tamura, Sci. Rep. Osaka Univ. 17:48. 1968.

29. *Aquilegia* L., *Sp. pl.* 1:533. 1753. *Gen. pl.*, ed. 5. 237. 1754. (24). Columbine.

Tribe 16. **Thalictreae** (Heintze) Duncan & Keener, *stat. nov.* BASIONYM: Thalictroideae Heintze, *Cormofyternas fylogeni* 103. 1927.

30. *Thalictrum* L., *Sp. pl.* 1:545. 1753. *Gen. pl.*, ed. 5. 242. 1754. (35). Rue.

Phytologia (January 1991) 70(1):28-41.

CEANOTHUS OPHIOCHILUS (RHAMNACEAE): A DISTINCTIVE, NARROWLY ENDEMIC SPECIES FROM RIVERSIDE COUNTY, CALIFORNIA

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ABSTRACT

A newly discovered species, **Ceanothus ophiochilus**, is described from Riverside County, California. Unusually small, narrow, semi-terete leaves distinguish this species from other members of section *Cerastes*. Its blue to pinkish lavender flowers, rather than white, further separate the taxon from other members of the section in southern California. The solitary population is restricted to an unusual pyroxenite rich outcrop on privately held land being considered for development.

KEY WORDS: *Ceanothus, Cerastes*, Rhamnaceae, edaphic endemic, pyroxenite endemic, endangered species.

INTRODUCTION

The species of *Ceanothus* section *Cerastes* are characterized by persistent, coriaceous leaves with stomata in sunken pits; thick, darkly colored, corky stipules; and flowers in axillary umbels. All but two species have opposite leaves and most have capsules bearing three horns (McMinn 1942; Munz 1974). Raven (1977) reports that of the 21 species in the section, 20 occur in California, with 17 endemic to the California Floristic Province. The section is especially well represented in the central and northern part of the state, where several of the taxa are edaphic endemics. At least two species are confined to serpentine soils (Nobs 1963; Kruckeberg 1984); one is limited to Franciscan marine sandstones of Jurassic age; and five are restricted to Pliocene Sonoma volcanics (Nobs 1963). Depending on which treatment is followed, seven to eight taxa, representing five or six species and four varieties, have traditionally been recognized for Southern California (McMinn 1942; Munz 1959, 1974). In this paper, we describe a narrowly endemic species of *Ceanothus*, section

Cerastes, which we encountered in March, 1989, while conducting floristic surveys of a large, privately held parcel surrounding Vail Lake in southwestern Riverside County, California. This plant is an edaphic endemic and is known only from the type locality where it is restricted to an unusual, pyroxenite rich outcrop. The continued existence in the wild of this attractive species is threatened by potential urbanization of the site.

TAXONOMY

Ceanothus ophiochilus Boyd, Ross, & Arnseth, *sp. nov.* Figure 1

Frutex rotundatus, ramosissimus, (3.0-) 12-15 (-20.) dm altus. *Caules basilares* 1-aliquot, trunco principale ad 7.2 cm diametro basi, interdum aspectu funis textilem. *Cortex* laevis comparate, cinereus ad schistaceum vel castaneum in veteribus truncis decorticantibus. *Rami* divaricati, cinerei, internodiis (2.0-) 2.5-7.0 (-13) mm longis; ramis hornotinis ferrugineis, pilos parcos breves gerentibus, mox glabrescentibus; stipulis hornotinis ferrugineis, sed maturis ferro-griseis, suberosis. *Folia* opposita, glabra, coriacea, fasciculata in ramis maturis, flavovirentia ad viridia, ambitu angusteoblanceolata ad obovata, (2.0-) 3.5-7.0 mm longa, (1.0-) 1.5-2.5 (-3.0) mm lata, supra concava subtus gibbosa, 0.8-1.0 mm crassa; apicibus denticulatibus vel rotundatibus vel emarginatibus; marginibus integris vel 1-2 (-3) paribus denticulatibus; costis distinguibilibus sed nervatura secundaria obscura generaliter; petiolis 0.55-1.0 mm longis, 0.4 mm latis. *Flores* 6-8 in umbellis lateralibus, sublazulini vel subrosei vel lactei. *Bracteae inflorescentiae* 2, rotundatae, ciliatae, 1.7-2.0 mm diametro, evanescentes. *Pedunculus* 1-3 mm longus, pedicellis 2.2-5.0 mm longis. *Calyx* rotatus, glabrus, 3-5 mm diametro, sepalis ovato-deltoideis, 1.0-1.5 mm longis. *Discus glandularis* violaceus, 1.5 mm diametro. *Stylus* 1.5-1.8 mm longus, stigmate trilobato, lobis circa 0.1 mm longis. *Filamenta staminum* 1.4-1.8 mm longa, antheris 0.8 mm longis. *Petala* unguiculata, 2 mm longa, leniter deflexa, laminis cyathiformis 1 mm longis. *Capsula* globosa, circa 3.3 mm diametro, rubella ubi immatura, brunnea hebetata ubi matura, cornibus lateralibus absentibus vel raro vestigialibus, cristis intermediis absentibus. *Semina* 3, politae, brunneae ad fusco-nigras, 2.2 mm longae. Florescentia in circa medio Februario ad Martio, fructibus maturescentibus post 2.5-3.0 menses.

TYPE: U.S.A. California: Riverside Co., Vail Lake area, 1 mile W of lake, T8S, R1W SE$\frac{1}{4}$ SE$\frac{1}{4}$ section 8, SW$\frac{1}{4}$ SW$\frac{1}{4}$ section

9; 2000-2099 feet. Restricted to series of N-facing slopes. 19 March 1989, *Steve Boyd, Tim Ross, Laurel Arnseth 3020* (HOLOTYPE: RSA; Isotypes: CAS, MO, SD, SJSU, UC, UCR, US, and 14 others to be distributed).

Paratypes. – U.S.A. California: Riverside Co., same location as above, 12 March 1989 (fl.), *Steve Boyd, Tim Ross, Laurel Arnseth 2960* (CAS, MO, SJSU, RSA, UCR); same location as above, 31 March 1989 (fr.), *Steve Boyd, Tim Ross, Laurel Arnseth 3097* (CAS, MO, RSA, SD, SJSU, UC, UCR, US, and 14 others to be distributed).

Rounded, divaricately branched shrub, (3.0-) 12-15 (-20.) dm tall. Basal stems one to several, with the main trunk to 7.2 cm in diameter and eventually developing a braided appearance. Bark relatively smooth, ash gray to slate gray or occasionally ranging to reddish brown on exfoliating trunks. Young twigs reddish brown maturing to ashy gray with internodes (2.0-) 2.5-7.0 (-13) mm in length. Stipules on new growth are reddish brown, ultimately becoming iron gray with a corky texture. Leaves glabrous, coriaceous, yellow green to medium green, opposite on stems of recent growth, becoming fascicled on short axillary spur branches in older wood; narrowly oblanceolate to obovate, (2.0-) 3.5-7.0 mm long, (1.0-) 1.5-2.5 (-3.0) mm wide, 0.8-1.0 mm thick; the adaxial surface shallowly concave folded; abaxial surface strongly convex, ± gibbous; the margins entire, or occasionally with 1-2 (-3) pairs of minute teeth; the apex bearing a tooth, or rounded, or emarginate. Midrib visible on abaxial surface, but lateral veins generally obscured. Petioles 0.55-1.0 mm long, 0.4 mm wide, sparsely appressed pubescent in youngest leaves but soon glabrous. Inflorescences axillary on peduncles 1-3 mm long, mostly 6-8 flowered. Floral bud scales 2, pinkish, broadly ovate to orbicular, 1.7-2.0 mm long, sparsely puberulent abaxially towards the apex, with ciliate margins; evanescent. Peduncles 1-3 mm long. Pedicels 2.2-5.0 mm long, usually deeply pigmented at anthesis. Calyx at anthesis 3-5 mm broad, glabrous, the lobes ovate-deltoid, 1.0-1.5 mm long. Flowers pale blue or rarely pinkish lavender, fading to white after anthesis due to loss of pigmentation in pedicel and glandular disk. Petals ladle shaped, 2 mm long, equally divided between the filiform claw and the deeply saccate blade. Style 1.5-1.8 mm long, trilobate, each lobe circa 0.1 mm long. Staminal filaments 1.4-1.8 mm long; anthers 0.8 mm long. Capsule globose, 3.3 mm in diameter, hornless or rarely with 3 rudimentary lateral horns; shiny and ± reddish when young, becoming dull light brown when mature. Seeds medium to dark brown with polished surfaces, convex abaxially, angled on inner face; 2.2 mm long. Flowering occurs in approximately mid-February to March, with maturation of the capsules in about late May to mid-June.

Close observation of the rounded leaf margins reveals a distinctive pattern resembling the labial scales about the mouths of some snake species.

This characteristic patterning served as the inspiration for the specific epithet, *ophiochilus* (Greek, *ophis* [snake, serpent]; *cheilos* [lip]). Because the sole population overlooks Vail Lake, we would like to suggest the name "Vail Lake Ceanothus" as the vernacular for this species.

DISCUSSION

Ceanothus ophiochilus is known only from the type locality where it grows on a series of contiguous north-facing slopes and ridge tops between 1980′ and 2090′ on the eastern slopes of Oak Mountain[1], 1 mile west of Vail Lake. The entire population is restricted to about 20 acres of a pyroxenite rich outcrop which totals about 40 acres in area. It is surprising that a plant as distinctive as *C. ophiochilus* could remain undetected in a region as relatively well explored botanically as Southern California. Historical factors have certainly played a role in this regard. The Vail Lake area has long been inaccessible to botanists, having been a part of the sprawling Vail Ranch and later held in private ownership by recreational vehicle parks and now developers. The area did receive some attention from such notable botanists as Philip Munz, F.W. Peirson, Marcus E. Jones, and Edmund Jaeger during the early part of this century. However, at that time, the *C. ophiochilus* population, which is surrounded by dense chaparral on all sides, would still have been some distance from any contemporary access roads. It is likely that past botanical exploration in this region has been confined to those areas most readily accessible from the main highways. An extensive area from Mount Palomar northward to Bautista Canyon apparently remains completely unexplored botanically.

It appears unlikely that other populations of *Ceanothus ophiochilus* exist, however. The Oak Mountain pyroxenite rich outcrop is unusually large, yet it has not been reported by geologists working in the area (Morton 1989, pers. comm.; Seay 1964; Mann 1955; Rogers 1965). Morton (1989, pers. comm.) indicated that other large pyroxenite rich outcrops are not known from the surrounding area and that the presence of similar large outcrops is doubtful. He suggested a possible link between the outcrop and past thermal activity associated with a small, extinct volcano of late Pleistocene or sub-Recent age (Mann 1955) at the mouth of Temecula Creek Canyon, approximately 1 mile to the northwest. No distinction of soil type is indicated by U.S. Soil Conservation Service maps (Knecht 1971). However, Tullock, *et. al.* (1989, pers. comm.) found that soil samples taken within the areas supporting *C. ophiochilus* were deficient in phosphorus, with ridgetop soils having no detectable amounts.

[1][Note: The name "Oak Mountain" has been applied by the USGS to two important physical features in the Vail Lake area; in this case we refer to the 2130-foot "Oak Mountain" (USGS 7.5′ Vail Lake quadrangle) which corresponds to Mann's (1955) "Vail Mountain" vs. the 2705-foot "Oak Mountain" north of Vail Lake (USGS 7.5′ Sage quadrangle).]

Ceanothus ophiochilus is unique among the *Cerastes* taxa from Southern California in having blue to pinkish lavender flowers rather than the usual white to cream white. However, the leaves are the most striking morphological feature of *C. ophiochilus* and unequivocally distinguish it from all other taxa in section *Cerastes*. No other species in the section is reported to have leaves as small and narrow, and no other species in either section of *Ceanothus* has been reported to possess leaves with a strongly gibbous lower surface (Figure 2, Figure 3). Another morphological feature apparently unique to *C. ophiochilus* relative to other members of section *Cerastes* is the general lack of pubescence, especially on the abaxial leaf surface. Except for the very youngest leaves at growth tips, leaf pubescence is limited to the trichomes guarding the entrance to each stomatal crypt (Figure 3, Figure 4). Stomatal crypt structure appears to be Type II as defined by Nobs (1963), with the trichomes confined to the border of the crypt aperture.

The tiny, fascicled leaves of *Ceanothus ophiochilus* give vegetative plants a strikingly similar appearance to *Adenostoma fasciculatum* Hook. & Arnott, the codominant shrub at the type locality. This condition may also help to explain the relatively late discovery of this species. Except during the brief flowering period, *C. ophiochilus* is difficult to differentiate from the surrounding *Adenostoma* without relatively close examination.

Using McMinn's (1942) treatment of the genus, *Ceanothus ophiochilus* keys to *C. ramulosus* (E. Greene) McMinn var. *fascicularis* McMinn. This is based on the shared characters of hornless capsules, relatively entire leaf margins, leaves borne in axillary fascicles in older wood, and light blue to pale lavender flowers. That taxon, however, is endemic to coastal terraces in Santa Barbara and San Luis Obispo counties, California, and differs in having slender, spreading branches; a larger capsule (4.7 mm); and larger (6-20 mm), planar leaves which are dark green on the upper surface and minutely canescent on the lower surface (McMinn 1942; Munz 1959). *Ceanothus ramulosus* var. *fascicularis* also differs in possessing Type I stomatal crypts (Nobs 1963).

Using Munz's (1974) floristic treatment for southern California, *Ceanothus ophiochilus* keys (albeit not smoothly) to *C. greggii* A. Gray. This is based primarily on the concave upper leaf surface and relatively small, lateral horns on the capsules (at most, vestigial in *C. ophiochilus*, but also vestigial in some forms of *C. greggii*). *Ceanothus greggii* is a highly variable, primarily desert, species which ranges from Oaxaca, México, in the south, northward through the Chihuahuan, Sonoran, Mojave, and Great Basin Deserts, as well as into the arid interior cismontane regions of southern California (McMinn 1942). The species is represented by three more-or-less geographically defined varieties: the typical var. *greggii*; var. *vestitus* (E. Greene) McMinn; and var. *perplexans* (Trelease) Jeps. (McMinn 1942). Variety *greggii* ranges northward from Oaxaca, México, into Texas, New Mexico, and Arizona. Variety *vestitus* ranges northward from Arizona through Nevada and Utah, and westward into Cali-

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Figure 1. *Ceanothus ophiochilus* Boyd, Ross, & Arnseth, sp. nov. A) Flowering stem illustrating divaricate branching pattern and fascicled leaves on older wood. B) Flower detail. Glandular disk surrounding ovary provides much of the floral color. C) Leaf fascicle and four leaves removed from one plant to show variation in size, shape, and margin. Note vestigial marginal teeth on several leaves. D) Inflorescence (lower flowers removed). E) Infructescence, one capsule having dehisced. F) Individual seed, abaxial and adaxial views. Scale bar increments = 1mm.

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Figure 2. *In situ* photograph of *Ceanothus ophiochilus* in late anthesis showing early fruit development. Photo taken April 1, 1989.

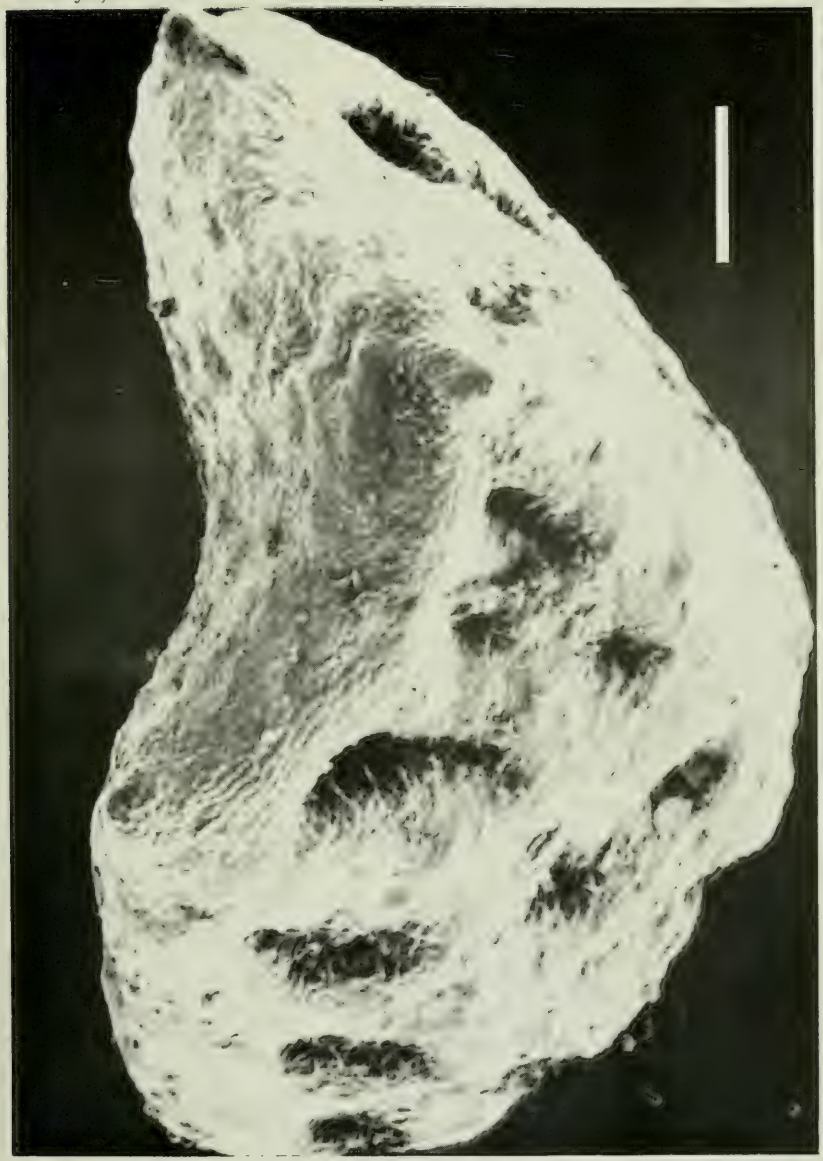

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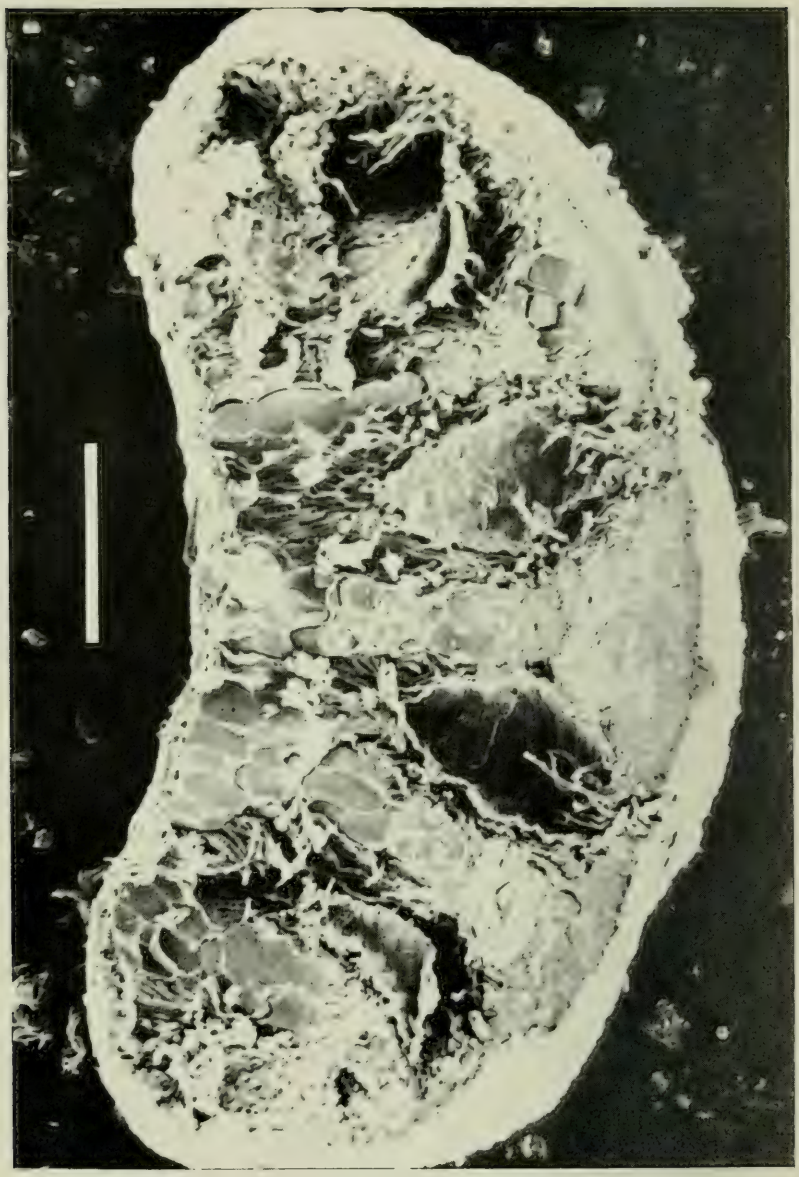
Figure 3. SEM photograph showing a near-apical view of *Ceanothus ophiochilus* leaf with three vestigial teeth, one apical and two marginal. Note the glabrous surfaces, pubescence being limited to the entrances of the stomatal crypts. Scale bar = 200 microns.



CEANOTHUS OPHIOCHILUS (RHAMNACEAE): A DISTINCTIVE, NARROWLY ENDEMIC SPECIES FROM RIVERSIDE COUNTY, CALIFORNIA

Steve Boyd, Timothy Ross, Laurel Arnseth

Figure 4. SEM photograph of cross-section through a *Ceanothus ophiochilus* leaf illustrating concave upper surface, rounded margins, strongly convex underside, and relatively large, Type II stomatal crypts with trichomes limited to the crypt aperture. Photosynthetic mesophyll is apparently limited to the area immediately surrounding the stomatal crypts with most of the remaining area occupied by bundle sheath extension cells. Scale bar = 200 microns.

fornia through the Mojave Desert ranges as far as southern San Luis Obispo County. Variety *perplexans* occurs in California from the southern slopes of the San Bernardino and Little San Bernardino Mountains southward through the peninsular ranges into northern Baja California. This third taxon occurs as a common element in desert transition chaparral vegetation on the Anza Bench, less than 10 miles east of Vail Lake.

Ceanothus greggii differs from *C. ophiochilus* in possessing larger leaves (9-19 mm long, 6-9 mm wide) which are not fascicled in older wood, and which are grayish canescent on both surfaces in vars. *greggii* and *vestitus* and on the lower surface in var. *perplexans*. These taxa also differ from *C. ophiochilus* in possessing Type III stomatal crypts (Nobs 1963). Likewise, the capsules are generally larger (3-5 mm in diameter), and the flowers are white.

In overall morphological aspect, *Ceanothus ophiochilus* more closely approaches *C. greggii* than *C. ramulosus* var. *fascicularis*. The shallowly concave folded upper leaf surface of *C. ophiochilus* suggests a xeromorphic reduction of *C. greggii* (s.l.) leaves and the yellowish green leaf color is similar to that in *C. greggii* var. *perplexans*. Likewise, the branching patterns of *C. ophiochilus* and *C. greggii* are similar. On the basis of shared morphological features, it would appear that the closest affinities of *C. ophiochilus* may lie with the *C. greggii* complex. We are hesitant, however, to speculate further on the relationships or possible origins of *C. ophiochilus* solely on the basis of morphology. The complexities inherent in edaphic endemism (Raven 1964; Mason 1946a,b) may, in this instance, be further complicated by hybridization and introgression with contemporary sympatric *Ceanothus* species over geologic time. The relationships of *C. ophiochilus* to other taxa in the section would best be elucidated through a comprehensive analysis of introgressive hybridization and reticulate evolution within the section as a whole.

The xeromorphic features exhibited by *Ceanothus ophiochilus*, especially reduction of leaf size, plant stature, and pubescence, correspond with morphological responses to serpentine substrates as exhibited by numerous other taxa (Kruckeberg 1984). While the Oak Mountain substrate is not serpentine, it is similar to many serpentine outcrops in its rocky, poorly developed soil strata, low levels of calcium, and extremely low amounts of available phosphorus (Kruckeberg 1984). Because of the combination of harsh physical features and the stresses related to the chemical composition of the soil, it is not unexpected to observe similar morphological responses on the Oak Mountain outcrop.

Today, selective survivability on this substrate may play an important role in maintaining the integrity of *Ceanothus ophiochilus* as a distinct species. Extensive interspecific hybridization is well known in *Ceanothus*, especially in section *Cerastes* (McMinn 1944; Nobs 1963). It is not surprising, therefore, that several individuals of suspected hybrid origin were located within the *C. ophiochilus* population (*Boyd, Ross, & Arnseth Nos 3017, 3018, 3098, 3099* [all

RSA]). Large populations of *C. crassifolius* Torr. are present on sedimentary substrates less than one-half mile to the south and east of the *C. ophiochilus* population. In 1989, anthesis in the *C. crassifolius* populations in the Vail Lake area overlapped and extended beyond that of *C. ophiochilus*; consequently, it appears that ample opportunity exists for gene flow between the two taxa. *Ceanothus crassifolius* differs considerably from *C. ophiochilus* in characters and general appearance. This white flowered species is a stout, erect, openly branched shrub 2.0-3.5 m in height with tomentose twigs. Leaves are broadly elliptic to ± elliptic obovate, 15-30 mm long, strongly revolute to nearly planar, olive green and glabrous above, and white tomentose beneath. The viscid fruits are globose with short (but prominent), subdorsal horns and are 7-8 mm broad (Munz 1959). *Ceanothus crassifolius* does, however, share with *C. ophiochilus* the Type II stomatal crypt (Nobs 1963). The hybrid plants that we observed displayed various stages of intermediacy between these two taxa. Interestingly, all suspected hybrids were found growing at the margins of the *C. ophiochilus* population, near the contact zone with adjacent metasedimentary substrates.

The species of *Ceanothus* section *Cerastes* lack the ability to crown-sprout and only reproduce from seeds stored in the soil, generally in response to fire or physical disturbance (Hadley 1961; Raven 1977). We suspect that *C. ophiochilus*, while occasionally hybridizing with *C. crassifolius*, is maintained in relatively pure stands due to differential establishment of seedlings following fire. *Ceanothus ophiochilus* is probably better able to tolerate the unusual edaphic conditions present on the outcrop than is the regionally more abundant *C. crassifolius*. Apparently, hybrid individuals become established and flourish only at the margins of the outcrop where unfavorable edaphic conditions have been ameliorated.

The long term prospects for the continued existence of *Ceanothus ophiochilus* in the wild are uncertain at this time due to the threat of human encroachment. Southwestern Riverside County is currently undergoing some of the most rapid urbanization anywhere in the state and, regrettably, *C. ophiochilus* occupies a locality now considered suitable for development. It does not stand alone. The Vail Lake region also harbors the largest known populations of both the state listed *Mahonia nevinii* (A. Gray) Fedde [= *Berberis nevinii* A. Gray] and the federally listed *Dodecahema leptoceras* (A. Gray) Reveal & Hardham [= *Centrostegia leptoceras* A. Gray; *Chorizanthe leptoceras* (A. Gray) S. Watson], as well as significant populations of several other sensitive taxa (Boyd, Arnseth, & Ross 1989). While these other taxa occur elsewhere in limited numbers, the development of the site on which the sole population of *Ceanothus ophiochilus* occurs would result in the extirpation of the species in its wild state. Even partial development of the land surrounding the site presents a serious threat to the species. Changes in fire regime, either through suppression or through the introduction of unnaturally more frequent burns, could prove disastrous. Likewise, given the unique dynamics involved between the

species and its substrate, we completely reject *ex-situ* preservation *alone* as an option, especially given the degree to which *Ceanothus* are known to hybridize in the artificial confines of cultivation. We recommend that any development plans implemented in the region provide *reasonable* and *effective* protection for these plants.

Ceanothus ophiochilus should be immediately added to list 1B of the California Native Plant Society's Inventory of Rare and Endangered Vascular Plants with a R-E-D code of 3-3-3, its most sensitive rating. The species is limited to a solitary, highly restricted population; is endemic to the state of California; and is currently endangered by proposed development of the area. In addition, we strongly urge the immediate listing of *Ceanothus ophiochilus* as an endangered species by the California Department of Fish and Game, and by the United States Fish and Wildlife Service to provide this species the greatest legal protection possible from encroachment by human activities.

ACKNOWLEDGMENTS

We express our thanks to Dr. Clifford Schmidt, Dr. Sherwin Carlquist, and Andrew C. Sanders for reviewing this manuscript and offering various comments and suggestions. Special thanks to Kendall for providing the excellent line drawing in spite of our pitiably low budget. Thanks to Dr. Robert Tullock, Leta Barber, Vince Gallegos, and Matt Riha for having devoted so much time to analyzing soil samples from the Vail Lake site. Thanks also to Dr. Douglas Morton for personal observations relative to the geology of western Riverside County with specific regard to the substrate at the site, to Dr. Carlquist for providing the SEM photos, and to Dr. Scott Zona, Michael Hanson, Hugo Cota, and several others for assistance in various ways.

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Phytologia (January 1991) 70(1):42-43.

A NEW SPECIES OF *COREOCARPUS* (ASTERACEAE - COREOPSIDEAE) FROM MÉXICO STATE, MÉXICO

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ABSTRACT

A new species, **Coreocarpus ixtapanus**, from the state of México, is described. It is closely related to *C. congregatus* (S.F. Blake) E.B. Smith of Sinaloa and Durango. Both of these taxa appear to be anomalous in *Coreocarpus*. The taxonomic implications of this anomaly are briefly discussed.

KEY WORDS: Asteraceae, Coreopsideae, *Coreocarpus*, México.

Routine identification of Mexican Asteraceae has revealed the following novelty.

Coreocarpus ixtapanus B. Turner, *sp. nov.*

Coreocarpo congregato (S.F. Blake) E.B. Smith similis sed plantis minoribus foliis ac capitulis minoribus, et antheris luteis (vs. purpureis) differt.

TYPE: MÉXICO. Estado México: Mpio. Tonatico, along Mexican hiway 55, a few mi S of Ixtapan de la Sal, ca. 1800 m, 14 Oct 1962, *D.L. & M.L. Denham 172* (HOLOTYPE: COLO!).

Delicate slender annual 10-26 cm high. Stems terete, sparsely hirsute, more so at the nodes. Leaves opposite, 3-6 pairs to a stem, 8-15 mm long, 3-10 mm wide; petioles 1-2 mm long; blades mostly tripinnatisect, sometimes merely trilobate, sparsely hirsute with clear multiseptate hairs 0.5-1.5 mm long. Heads 1 or 2 to a stem, the peduncles mostly 2-3 cm long at maturity. Involucres ca. 6 cm high; outer herbaceous bracts 5-8 in a single series, 3-4 mm long, 0.5-0.8 mm wide; inner petaloid bracts yellow, 5-6 mm long, ca. 2 mm wide, the apices acute. Receptacular bracts linear-lanceolate, yellow, longer than the florets, the apices narrowly acute. Ray florets 5-8, yellow, 2-5 mm long, neuter, presumably sterile. Disk florets 7-10 per head, the corollas ca.

2.5 mm long, the throats ca. 0.8 mm long, sparsely glandular pubescent, the limb ca. 1.7 mm long. Anther sacs yellow with narrowly acute appendages. Style branches abruptly apiculate apically. Achenes (the outer series) broadly obovate, black, incurved, ca. 2.5 mm high, ca. 2 mm wide, the margins with a narrow somewhat corky wing, epappose.

The species is known only by the type sheet upon which are mounted 10 specimens; 9 of these are very delicate with rather minute heads, the remainder is ca. 26 cm high.

Coreocarpus ixtapanus Turner is clearly related to *C. congregatus* (S.F. Blake) E.B. Smith, of Sinaloa and closely adjacent Durango, but the latter is a much more robust plant with larger leaves, larger heads with more numerous ray and disk florets, the anthers decidedly purple (vs. yellow).

Blake originally described *Coreocarpus congregatus* as belonging to the genus *Coreopsis*, but Smith (1989) transferred the species to *Coreocarpus* where it appears to be anomalous. Melchert (pers. comm.), who has exceptional familiarity with the genus *Bidens*, excludes it from the latter genus. As already noted, *Coreocarpus congregatus* and *Coreocarpus ixtapanus* differ markedly from other species of *Coreocarpus* in possessing dimorphic involucral bracts, much as in *Bidens*; additionally, the ray florets of these two species are neuter, whereas those of the remaining taxa are pistillate. Smith (1989) positioned *Coreopsis congestus* in *Coreocarpus*, largely because of the incurved peripheral achenes, which resemble those of most taxa of *Coreocarpus*, but he also called attention to its resemblance to *Coreocarpus hintonii* Sherff and *Coreocarpus cronquistii* Sherff, both of which are positioned within *Bidens* by Melchert (cf. Melchert & Turner 1990). In short, *Coreocarpus congregatus* and *Coreocarpus ixtapanus* appear to stand somewhere between *Coreocarpus* and *Bidens*, and both species might ultimately reside in their own genus, if not within an expanded *Bidens*.

ACKNOWLEDGMENTS

I am grateful to Dr. Bill Weber for the loan of material from COLO; Dr. Guy Nesom provided the Latin diagnosis and reviewed the manuscript, as did Dr. Andrew McDonald.

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Phytologia (January 1991) 70(1):44-46.

A NEW GYPSOPHILIC SPECIES OF *MIRABILIS* (NYCTAGINACEAE) FROM NUEVO LEÓN, MÉXICO

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ABSTRACT

A new species, **Mirabilis nesomii**, is described and illustrated. It is known from only three collections, all of which were obtained from exposed gypseous outcrops at the western base of Cerro Peña Nevada in southern Nuevo León, México.

KEY WORDS: *Mirabilis*, Nyctaginaceae, México

Routine identification of plants from northern México has revealed the following novelty.

Mirabilis nesomii B. Turner, *sp. nov.*, Figure 1.

Mirabili glabrifoliae (Ort.) I.M. Johnston similis sed laminis foliorum lineari-lanceolatis plerumque 1-3 mm latisque (vs. ovatis vel cordatis plerumque 10-40 mm latisque) differt.

TYPE: MÉXICO. Nuevo León: ca. 30 km ENE of Dr. Arroyo, 8 km ENE of San Antonio de Peña Nevada, W base of Cerro Peña Nevada, large area of gypsum hills and outcrops, 1950-2050 m, 30 Jul 1983, *Guy Nesom 4704* (HOLOTYPE: TEX!; Isotype: MEXU).

Perennial glaucescent herbs 25-35 cm high. Stems erect, glaucescent, glandular punctate, pubescent at nodes, with vestiture extending between nodes in narrow bands mostly ca. 1 mm wide, otherwise glabrous. Leaves linear-lanceolate, mostly 3-8 cm long, 0.1-0.3 cm wide, glabrous or nearly so, the margins enrolled, most of the foliage confined to the lower 1/3 of the stem, the upper leaves much reduced and scalelike. Flowers on 2-3 terminal, bracteate, branches, the latter 3-10 cm long, the ultimate involucres borne on pilose peduncles 5-6 mm long. Involucres ca. 8 mm high at maturity, 5 parted, the bracts united for about 5/8 their length, pubescent with multiseptate trichomes. Petaloid structures apparently pink, ca. 10 mm high and twice as

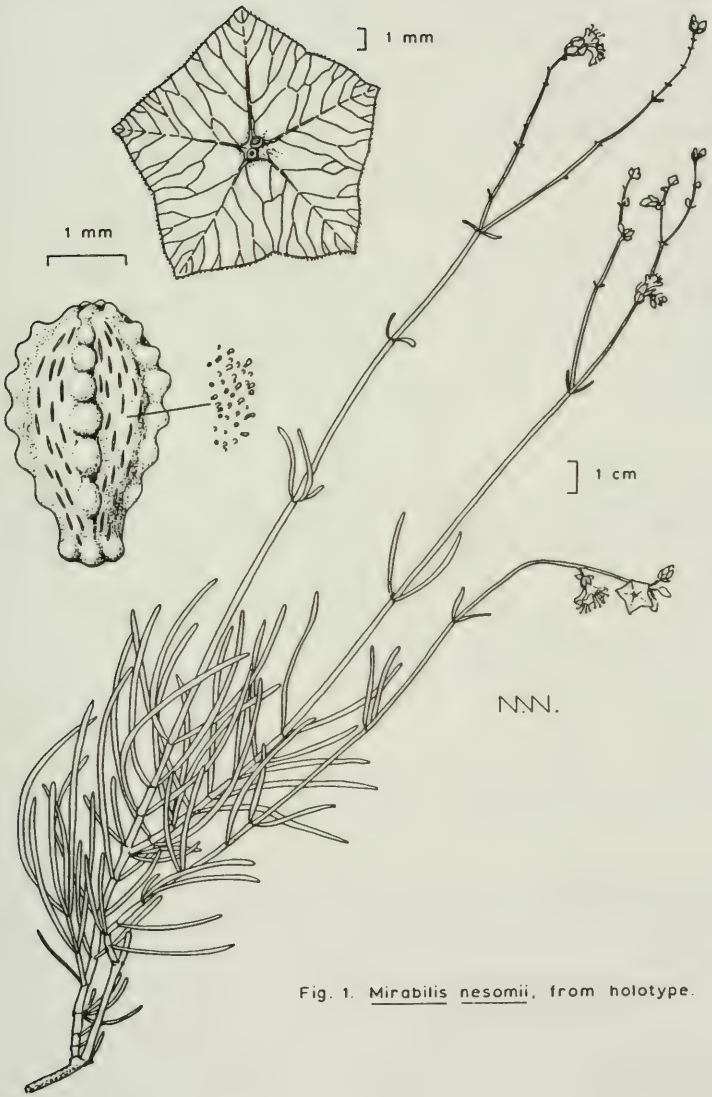

Fig. 1. Mirabilis nesomii, from holotype.

wide, the stamens ca. 12 mm long, exserted. Fruiting bodies (anthocarp) broadly clavate, ca. 3.5 mm long, the stipe ca. 0.6 mm long, the body with 5 tuberculate ribs, between these a very fine vestiture of minute glandular hairs.

ADDITIONAL SPECIMENS EXAMINED (Paratypes): MÉXICO. Nuevo León: 2.5 km ENE of San Antonio de Peña Nevada, W base of Cerro Peña Nevada, ca. 2000 m, 3-5 Aug 1981, *Nesom 4275* (TEX, MEXU); ca. 7 km NE of San Antonio Peña Nevada, Jul 1977, *Wells & Nesom 506* (TEX, unicate).

Mirabilis nesomii Turner, with its markedly linear-lanceolate, glaucescent leaves, superficially resembles *M. linearis* (Pursh) Heimerl, but is clearly more closely related to the widespread *M. glabrifolia* (Ort.) I.M. Johnston in characters of the involucre and fruit, the latter appearing almost indistinguishable from that of *M. nesomii*. *Mirabilis nesomii* differs from *M. glabrifolia* in being a much smaller plant, with fewer flowering branches and, as noted, by having linear or linear-lanceolate leaves, mostly 1-3 mm wide (vs. ovate to cordate and 10-40 mm wide).

ACKNOWLEDGMENTS

I am grateful to Guy Nesom for the Latin diagnosis and to him and Linda Escobar for reviewing the manuscript. Nancy Webber provided the illustration.

Phytologia (January 1991) 70(1):47-51.

STUDIES ON *MIKANIA* (COMPOSITAE: EUPATORIEAE) – XVII: TWO NEW SPECIES FROM MINAS GERAIS, BRAZIL

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ABSTRACT

Mikania citriodora and **Mikania hartbergii**, two new species from the Serra do Espinhaço, Minas Gerais, Brazil, are described and illustrated.

KEY WORDS: Compositae, Eupatorieae, *Mikania*, Minas Gerais, Brazil

Continued study of the genus *Mikania* has resulted in the recognition of the following new species from the Serra do Espinhaço, Grão Mogol, Minas Gerais, Brazil, an area characterized by a high rate of endemism.

Mikania citriodora W. Holmes, *sp. nov.* (Figure 1). TYPE: BRAZIL. Minas Gerais: Serra do Espinhaço, Grão Mogol, ca. 2 km from center of town via Vila Nova, 950 m; sandy soil over sandstone; common, 12 Jun 1990, *W.C. Holmes 5064* (HOLOTYPE: MBM; Isotypes: BAYLU, IBE, NLU, TEX).

Species ad *Mikaniam rufescem* Schultz-Bip. similis sed differt planta tomentosa (non glabra) et foliis crenato-dentatis (non integris).

Herbaceous to semiwoody sprawling to twining vines growing from elongated knotty caudices; stems terete, glabrate (at bases) to tomentose (upper parts); internodes to 20 cm long. Leaf blades ovate to ovate deltate, 2.2-4.0 x 1.3-4.0 cm, apices obtuse to rounded, margins crenate-dentate, bases obtuse to truncate to an acute insertion at the petioles, trinervate from near the base, surfaces tomentose, spotted with glandular resinous dots; petioles 1.0-1.3 cm long, tomentose. Capitulescences corymbose, 3-6 x 5-8 cm; branchlets terete, tomentose; bracts ovate, 0.8-1.7 x 1-2 cm, tomentose; ultimate

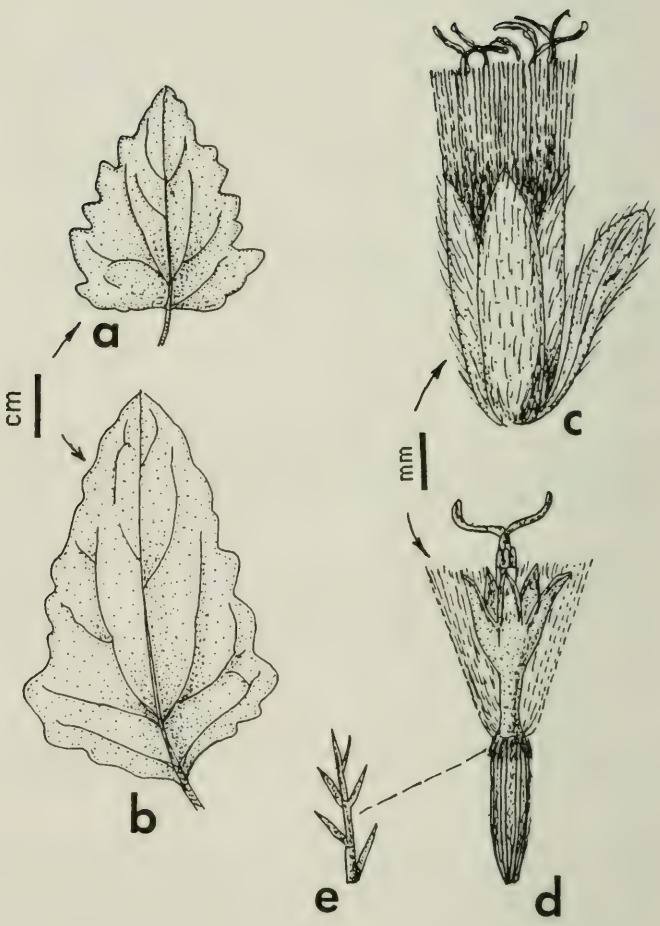

Figure 1. *Mikania citriodora* W. Holmes. A and B. leaves; C. head with phyllaries and subinvolucral bract; D. flower and achene; and E. branched trichome from upper part of achene.

branchlets 1.5-5.0 mm, tomentose. Heads 8-10 mm long; subinvolucral bracts oblanceolate to elliptic, 4-6 mm long, apices acute, surfaces pilose to tomentose. Phyllaries elliptic-oblong, 5.5-7.0 mm long, apices acute, surfaces pilose to tomentose. Corollas 3.8-5.0 mm long, creamy white, tubes 1.7-2.5 mm long, throats funnelform to semicampanulate, ca. 1 mm long, teeth ovate, triangular to triangular ovate, 1.1-1.5 mm long. Achenes 2.6-3.5 mm long, 7 ribbed, the ribs upwardly scabrid, surfaces olivaceous, pilose (to tomentose at the summit) with branched trichomes. Pappus bristles 5.0-5.5 mm long, white, 40-50, the margins scabrid.

PARATYPE: BRAZIL. Minas Gerais: Serra do Espinhaço, Grão Mogol, mountains to the west of town; 1170 m, sand over sandstone; common, 14 Jun 1990, *W.C. Holmes 5070* (BAYLU, IBE, MBM, NLU, TEX).

Mikania citriodora W. Holmes has several very unusual characteristics for the genus. The injured fresh stem has a faint smell of lemon, hence the specific name. While most species of *Mikania* have five ribbed achenes, the new species has achenes with seven ribs. Several species of erect *Mikania*, formerly included in the segregate genus *Kanimia*, are reported to have ten angled achenes. Certainly the most interesting trait is the presence of multicellular branched trichomes on the achenes, a trait not known in other *Mikania*. Typically, *Mikania* have multicellular, prominently jointed, but unbranched trichomes.

This is one of the few *Mikania* species reported to be aromatic. Others include *M. anisodora* Hassler, of Paraguay and Paraná, Brazil, the fresh foliage reportedly having an anise odor (Hassler 1915) and *M. aromatica* Oersted (Scharling & Oersted 1863), a Brazilian plant described as having the odor of cumin. The latter name is a synonym of *M. smilicina* DC.

Mikania hartbergii W. Holmes, *sp. nov.* (Figure 2). TYPE: BRAZIL. Minas Gerais: Serra do Espinhaço, Grão Mogol, mountains to the west of town, 1250 m, 14 Jun 1990, *W.C. Holmes 5071* (HOLOTYPE: MBM; Isotypes: BAYLU, IBE, NLU, TEX).

Species ad *Mikaniam neurocaulum* DC. similis sed differt caulibus teretibus (non profunde sulcatis) et foliis brevissime petiolatis (non longe petiolatis).

Erect to ascending suffrutescent herbs, 0.5-1.7 m tall, single to multistemmed from knotty rootstocks; stems terete, velutinous, ca. 1 cm in diameter at the base; internodes 2.0-3.5 cm long. Leaf blades ovate, 2.2-4.6 x 1.7-3.2 cm, semicoriaceous, apices acute to a mucronate point, margins entire to denticulate, often revolute, bases truncate to subcordate, venation subpinnate with 2 pairs of secondary nerves separating from the midvein within the lower 8 mm of the blade; upper surfaces hirsute to pilose, prominently reticulate,

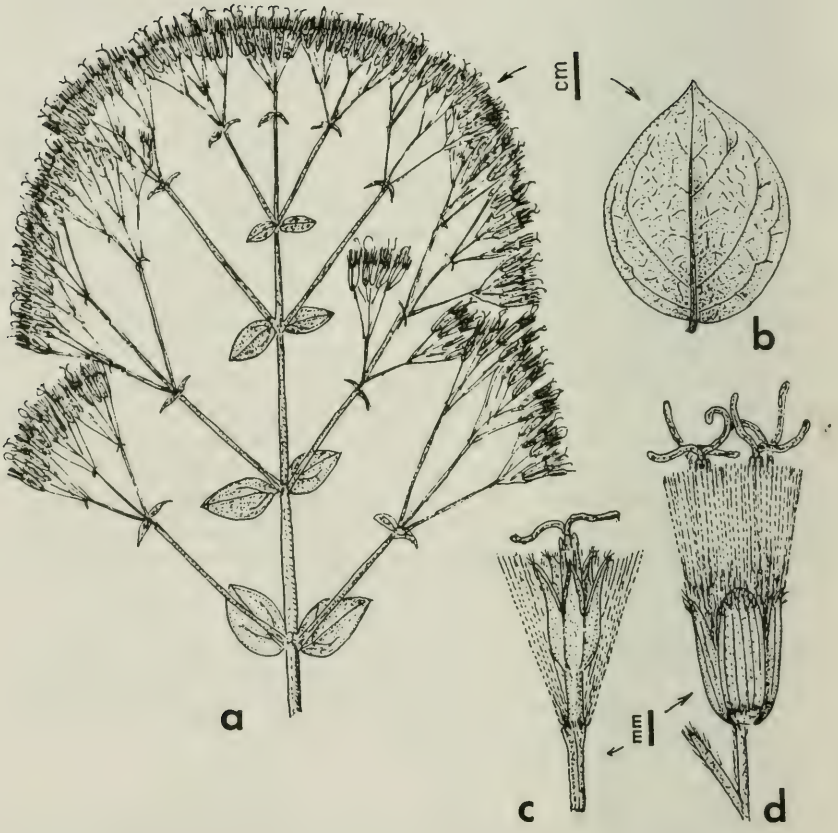

Figure 2. *Mikania hartbergii* W. Holmes. A capitulescence; B. leaf; C. flower and achene; D. head with phyllaries and subinvolucral bract.

lower surfaces velutinous to pilose, reticulate; petioles 1.0-2.5 mm long, velutinous. Capitulescences thyrsoid corymbs, 9-15 x 11-15 cm, the heads ultimately disposed in ternately branching and congested corymbs 1.0-1.5 x 1.5-3.0 cm; branchlets terete, velutinous; bracts similar to leaves but reduced in size; ultimate branchlets 0.5-3.5 mm long. Heads 6-8 mm long; subinvolucral bracts linear, 2.0-3.5 mm long, pilose especially on the apices and margins. Phyllaries ovate-oblong, ca. 3.8 mm long, apices rounded, ciliate-pilose, margins ciliate, surface glabrate to remotely puberulent; bases slightly calcarate. Corollas white, 4.8-5.2 mm long, tubes 1.6-1.7 mm long, throats funnelform to semicampanulate, 1.5-2.0 mm long, teeth lance-ovate, 1.2-1.5 mm long, sparingly pilose at the apices. Achenes (immature) ca. 1.8 mm long. Pappus bristles ca. 6 mm long, white, 35-40, margins scabrid, apices slightly thickened.

PARATYPE: BRAZIL. Minas Gerais: Serra do Espinhaço, Grão Mogol, mountains to the west of town, 1030 m, 14 Jun 1990, *W.C. Holmes 5068* (BAYLU, IBE, MBM, NLU, TEX).

The new erect to ascending species of *Mikania* is known only from the Serra do Espinhaço near Grão Mogol. Several colonies of about 10-12 plants were observed from 1030 to 1250 m altitude, but specimens were collected only from the two colonies that possessed mature flowers. Plants were usually rooted in dry, sandy crevices in sandstone.

The species appears closely related to *Mikania neurocaula* DC., but can be distinguished by its terete stems, truncate to subcordate leaf bases, and subsessile to very shortly pedicellate leaves. *Mikania neurocaula* is described as having profoundly sulcate stems, acute leaf bases, and leaves with petioles of about 1.5 cm long.

It is a pleasure to name this species for W. Keith Hartberg, Professor and Chairman of the Biology Department of Baylor University.

ACKNOWLEDGMENTS

I am grateful to Baylor University for providing financial support that made this study possible. I also wish to thank Sidney McDaniel and R. Dale Thomas for review of the manuscript and Gert Hatschbach for other assistance.

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Phytologia (January 1991) 70(1):52-57.

A NEW *PITCAIRNIA* (BROMELIACEAE) FROM PERÚ

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ABSTRACT

Pitcairnia cerrateana *sp. nov.* (Bromeliaceae) from Perú is described.

KEY WORDS: *Pitcairnia*, Bromeliaceae, Perú

Pitcairnia cerrateana L.B. Smith, *sp. nov.* Figures A-E. TYPE: PERÚ. Dep. Ancash: ascending to Huaylas, cerro subxerofilo, Prov. Huaylas, 1880-1920 m alt., 3 July 1988, *E. Cerrate 8967* (HOLOTYPE: USM!).

Ab omnibus speciebus adhuc cognitis foliorum laminis anguste triangularibus omnino serratis, inflorescentia simplici sepalis maximis differt.

PLANT flowering over 6 dm high. LEAVES 27 cm long; sheaths ovate, 5 cm long, laxly and minutely pale lepidote; blades narrowly triangular, 13 mm wide, laxly serrate with antrorse, slender, 3 mm long red spines. INFLORESCENCE simple, 27 cm long (immature), lax. FLORAL BRACTS suberect, ovate, acute, 11 cm long, exceeding the pedicels, subcoriaceous, farinose, flowers spreading, glabrescent. SEPALS oblong-lanceolate, 6 cm long, yellow (! *Cerrate*).

A new Pitcairnia from Peru

Figure A. Pitcairnia cerrateana L. B. Smith, base of floral axis.

Figure B. Pitcairnia cerrateana L. B. Smith, base of floral axis.

A new Pitcairnia from Peru

Figure C. Pitcairnia cerratcana L. B. Smith, inflorescence.

A new Pitcairnia from Peru

Figure D. Pitcairnia cerrateana L. B. Smith, young flower artificially opened.

A new Pitcairnia from Peru

Figure E. Pitcairnia cerrateana L. B. Smith, infrutescence.

Phytologia (January 1991) 70(1):58-59.

SOLIDAGO DURANGENSIS (ASTERACEAE: ASTEREAE) A NEW SPECIES FROM MÉXICO

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ABSTRACT

Solidago durangensis *sp. nov.* is known by only a few collections from the vicinity of the city of Durango, and it may now be extinct. The closest relative of the new species is hypothesized to be *S. paniculata* DC.

KEY WORDS: *Solidago*, Astereae, Asteraceae, México

Solidago durangensis Nesom, *sp. nov.* TYPE: MÉXICO. Durango (Edo.): city of Durango and vicinity, Apr-Nov 1896, *E. Palmer 363* (HOLOTYPE: US!; Isotype: US!).

Solidagini paniculatae DC. similis statura elata et capitulescentia paniculati-corymboideia ampla sed vestimento valde evoluto hispidulo, phyllariis brevioribus, et acheniis pubescentibus differt.

Herbs, probably perennial (base not seen), evenly hispidulous on the stems and leaves with white, erect or slightly crisped hairs less than 0.1 mm long, the stems apparently 1 m or more tall, yellowish green to slightly purplish. Leaves narrowly oblanceolate to elliptic-lanceolate, 1 or 3 nerved, 6-10 cm long at midstem, strongly reduced in size in the capitulescence, 6-9 mm wide, the margins slightly revolute, entire or the lower leaves with a few, minute teeth, axillary fascicles not produced. Heads secund in dense corymboid panicles, on bracteate pedicels; phyllaries in 3-4 subequal series, very thin, with a narrow orange midvein, the inner 3.0-3.5 mm long, triangular-lanceolate, the outer minutely fringed-ciliate, otherwise glabrous. Ray flowers 12-18, 2.5 mm long, the ligule ca. 1.5 mm long. Disc flowers 9-14, 3.5-3.8 mm long, the lobes 1.2-1.3 mm long. Achenes sparsely strigose with very thin hairs, 1.4-1.6 mm long, obtriangular-fusiform, with 6 orange resinous nerves; pappus of numerous barbellate bristles.

Additional collection examined: MÉXICO. Durango: city of Durango and vicinity, Apr-Nov 1896, *E. Palmer 217* (F, MO).

Although these plants are known only from a few relatively old collections, their morphology is extremely distinctive. Among the Mexican species of *Solidago*, the tall stature, relatively long leaves, large, paniculate-corymboid capitulescences, and the large number of ray flowers of *S. durangensis* Nesom are most similar to those of *S. paniculata* DC. In contrast, the newly described species differs from *S. paniculata* in its evenly and strongly developed, hispidulous (vs. glabrous) vestiture, much shorter (vs. 5-6 mm long) phyllaries, and pubescent (vs. glabrous) achenes. *Solidago paniculata* is closely related to other species occurring in México, *S. sempervirens* L., *S. stricta* Ait., and *S. confinis* A. Gray, all of which are glabrous and characteristically occur in wet habitats.

Although the habitat of *Solidago durangensis* is not known, it is likely that the collections were made from the wet, saline prairies on the east and northeast side of the city (1900-1950 m in elevation), where other narrowly endemic species of vascular plants are known to occur. Since recent collectors of Compositae from this area of Durango apparently have not encountered additional plants of this singular species, the original population may now be extinct, and a careful search for it needs to be made.

In the first phases of my study of Mexican *Solidago*, I annotated some specimens of *S. durangensis* as *S. missouriensis* Nutt., and although they have similarities at least in habit, the Mexican representatives of the latter differ from *S. durangensis* in their shorter stature, axillary fascicles of leaves, nearly glabrous stems and leaves, shallowly serrate blades, and smaller number of disc flowers. *Solidago missouriensis* in México is known only from central Coahuila.

ACKNOWLEDGMENTS

I thank Dr. B.L. Turner and Dr. A. McDonald for their review of the manuscript, Genevieve Lauer for her comments, the staffs of F, GH, and MO for loans of specimens, and the staff of US for their assistance during a visit there.

Phytologia (January 1991) 70(1):60-64.

BOOK REVIEWS

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The Encyclopedia of Evolution, Humanity's Search for its Origins. Richard Milner, foreword by Stephen Jay Gould. Facts on File, Inc., 460 Park Avenue South, New York, NY 10016. 1990. xii. 481 pp. $45.00 (hardcover). ISBN 0-8160-1472-8.

This book is not an encyclopedia in the usual sense of the word, where entries are included with brief definitions or descriptions. Instead, most of the entries in this work are given extensive treatment (the discussions of many entries are more than one page in length). In addition to the expected terms, personages, places, events, and themes of evolution, a wide variety of topics not usually associated with the idea of evolution or the teaching of evolution are also included. Some of the unexpected entries include "Fantasia," Lonesome George, Napi, King Kong, "Quest for Fire," Thomas Jefferson, the Sinclair Dinosaur, and many others. These additional entries tremendously expand the usefulness of the work by placing such entries in an evolutionary context, particularly as they pertain to the development of societies' perceptions of evolution.

The extensive use of cross referencing of entries and inclusion for many entries of related reading on the topics is an added feature not common in such works. Both techniques greatly enhance the value of the book and provide access to a much larger stock of knowledge than could otherwise be practically included in such a book. Milner's book is one which should be included in any educational library, from elementary school to universities. In light of the fact that it provides a context for many of the public's (mis)conceptions about evolution (a context that scientists are unfortunately often unaware of), Milner's book will also be useful for, and should be included in the personal library of, biologists who are in positions to communicate the concepts of evolution to nonscientists.

Indicator Plants of Coastal British Columbia. K. Klinka, V.J. Krajina, A. Ceska, & A.M. Scagel. University of British Columbia Press, #303–6344 Memorial Road, Vancouver, British Columbia V6T 1W5 CANADA. 1989. ix. 288 pp. $36.95 (flexible cover). ISBN 0-7748-0321-5.

Klinka, *et al.* summarize the usefulness as ecological indicators, of a number of plants from coastal British Columbia. Plants are described as indicators of climate, soil moisture, soil nitrogen content, and ground surface material. The content of the book is based largely on previous studies by the authors (particularly Klinka and Krajina). A summary of historical use of plants as ecological indicators in British Columbia is included. The concept of indicator species groups is described and reviewed. As one might expect, a number of plant species parallel one another in their responses to one or more environmental influences.

The main body of the book consists of a species listing in which over 400 species of plants are included. Each species treatment includes a color photograph of the plant, and a summary of ecological and geographic distribution of the species. Included plants are arranged in the listing alphabetically by genus (and by species within genera). A large diversity of species are included, from lichens, mosses and liverworts, to flowering plants. Although the book contains a wealth of ecological information, it may end up being used more by amateur plant collectors who will use the high quality photographs to identify their plants by comparison with the pictures, rather than being heavily used by professional ecologists.

The construction of the book appears to be solid. It is ostensibly built for field use, with the flexible water-resistant cover. The interior pages, although coated, might not withstand heavy field use, especially in a wet environment such as coastal British Columbia. One minor personal complaint about the book is the map on page 3, which is difficult to read, the symbols "CH" and "SH" appear on the map but not the key, and the lower panhandle of Alaska (which is almost completely surrounded by British Columbia and the coast) appears as a large open area in the map–not marked by the climatic zone boundaries found on the British Columbia portion of the map. All in all, the book should be useful for individuals undertaking ecological studies in the coastal regions of British Columbia.

Packrat Middens, The Last 40,000 Years of Biotic Change. Julio L. Betancourt, Thomas R. Van Devender, & Paul S. Martin (eds.). The University of Arizona Press, 1230 North Park, Suite 102, Tucson, AZ 85719. 1990. vii. 469 pp. $55.00 (clothbound). ISBN 0-8165-1115-2.

The present volume is a compendium of 21 chapters by 26 authors (some authors contributing to multiple chapters and most chapters written by multiple authors), summarizing the use of data from middens to infer the past vegetation of a region. Following the introduction (Chapter 1), the next five chapters (Part I) provide a basis for use of packrat middens as a sampling tool for vegetation analysis. These chapters describe what constitutes a packrat (*Neotoma*) midden, the behavior and ecology of packrats, accuracy of sampling from midden data as compared to contemporary field methods, and a summary of sources of material (by radiocarbon dates and geographic location) for data used in the analyses described in later chapters.

Part II includes chapters 7-12, each of which describes a summary of Late Quaternary vegetation and climate within a specific part of the study area (Chihuahuan, Sonoran, and Mohave deserts, as well as the Great Basin, Grand Canyon, and Colorado Plateau. Part III (Chapters 13-17) includes reports of use of packrat midden data for purposes other than describing complete regional vegetation patterns. These chapters compare midden data to pollen data at a site in Oregon, grass ecology in certain Sonoran Desert sites, mammal and arthropod distributions from material found in middens, and deuterium variations in cellulose.

The final section of the book includes three chapters describing the use for sampling paleovegetation, of middens produced by other animals in other parts of the world. The suggested possibilities include Hyrax and Dassie Rat middens in Africa, Hyrax from the Middle East, and Stick-Nest Rat middens from Australia. The last chapter in the book is a summary of the use of middens and prospectus for future use in vegetation studies.

The book provides considerable insight on vegetation in southwestern North America over the past 40,000 years. Not all of the data from packrat middens agrees with previous attempts to describe the vegetation of the region over the same time period. The book will be useful to many individuals, but particularly to systematists attempting to interpret variation patterns found in many plant and animal groups of the region. Many of the chapters are illustrated with drawings and photographs which enhance the text.

The Healing Forest, Medicinal and Toxic Plants of the Northwest Amazonia. Richard Evans Schultes & Robert F. Raffauf. Volume 2 of the Historical, Ethno- & Economic Botany Series edited by Theodore R. Dudley. Dioscorides Press, subsidiary of Timber Press, 9999 S.W. Wilshire, Portland, OR 97225. 1990. 484 pp. $59.95 + $3.00 shipping (hardcover). ISBN 0-931146-14-3.

The Healing Forest is a compendium of the use of medicinal and toxic plants from the Amazonian regions of Colombia, Ecuador, Venezuela, and far northwestern Brazil. Much of the field work leading to this text was completed in Colombia by the authors and their students. The primary sources of information about the plants were conversations with the native medicine men in the region of study and herbarium specimens on which such information was reported by other collectors. The local experts provided vernacular names for and uses of the plants. Specimens were collected and Latin names applied to the plants. In some cases, the plants have been subjected to chemical extraction (either by the authors, or more commonly, by other workers) to determine the molecules responsible for the active properties of the plants. The book begins with an extensive (27 pages) preface in which the northwest Amazonian region is briefly described, and the societies and tribal interactions of some of the native peoples are summarized. The preface is generously illustrated with black and white photographs, many of which show the tribal medicine men who served as sources of information.

The main body of the text consists of a listing of many of the medicinal and toxic plants of the region. Entries are ordered alphabetically by family, genus, and species. Each family included is briefly described, with a summary of number of genera and species in the family, geographic distribution of the family, economic importance of the family, and known chemical properties of the family. Similar summaries are found for each genus included in the book. Species are listed with full authorities and publication citations (no synonyms), a positive feature of the book that is not often found in similar books. Species listings include vernacular names and the name of the tribe(s) that uses the name. Native uses and methods of preparation of the plant are included in each species listing. Names and collection numbers for specimens from which data on plant use were collected are included where applicable. Ease of use of the book is somewhat impaired by the fact that although genus and species epithets are highlighted by boldface type where they are found in the alphabetized listing, the same names are not even italicized when found in the text of discussion of a particular taxon. Thus (for instance), where genera are mentioned in the general description of a family, the names for those genera are in the same type face as, and blend into the rest of the text. Many of the plants are illustrated by line drawings or black and white photographs. Each family listing ends with a literature summary of studies (mostly chemical) of

members of the family.

This book should prove to be a valuable reference for workers attempting to discover new sources of treatments for various ailments. It will provide at least a starting point in searches for future medicinal treatments. Unfortunately, many of the species listed in this book may soon disappear as the Amazonian forest is destroyed. Also unfortunate is the fact that the information about use of other species not listed in this book will probably disappear as the tribes who use them are brought into the "modern" world and encouraged not to use their traditional methods of medicine.

Phytologia (January 1991) 70(1):65-66.

BOOKS RECEIVED

Annual Review of Entomology, volume 36. Thomas E. Mittler, Frank J. Radovsky, & Vincent H. Resh (eds.). Annual Reviews Inc., Palo Alto, CA. 1991. ix. 703 pp. $40.00 (cloth) ISBN 0-8243-0136-6.

As with other volumes in this series, current literature and research in Entomology are summarized. Twentyeight papers are included, treating topics ranging from Abamectins to *Zophobas atratus*.

Ecology of Plant Communities, A phytosociological account of the British vegetation. Jack Rieley & Susan Page. Longman Scientific & Technical, John Wiley & Sons, Inc., New York, NY. 1990. ix. 178 pp. $98.00 (hardcover) ISBN 0-582-44639-2.

More than the title implies, this book is not only a phytosociological account of the British vegetation, but includes brief summaries of plant ecology in general as well as phytosociology (methods and terms) in particular. A brief account of worldwide vegetation is also included.

Orchid Biology, Reviews and Perspectives, V. Joseph Arditti (ed.). Timber Press, Inc., 9999 S.W. Wilshire, Portland, OR 97225. 1991. 451 pp. $58.00 + $3.00 shipping (hardcover) ISBN 0-88192-170-X.

This book is an interesting and unusual compilation of reports of scientific study, combined with nonscientific articles. As one might expect from the title, most of the information presented would be of use primarily to individuals particularly interested in orchids. Pieces included in the book include such diverse items as a chapter entitled "Orchids in my life" and a report of a rather detailed study of *Rhizanthella gardneri*, a parasitic orchid in which only the flower protrudes above the ground. Other articles include

summaries of self pollination in Orchidaceae, water relations in orchids, a literature review of *Dactylorhiza*, use of orchids in space research, and citations of orchids in literary works. A rather lengthy (100+ pages) appendix summarizes the known months of flowering for orchids found in cultivation. Most articles are illustrated (black and white).

The Encyclopedia of Evolution, Humanity's Search for its Origins. Richard Milner, foreword by Stephen Jay Gould. Facts on File, Inc., 460 Park Avenue South, New York, NY 10016 1990. xii. 481 pp. $45.00 (hardcover) ISBN 0-8160-1472-8.

See review on page 60.

Phytologia (January 1991) 70(1):67.

ERRORS AND ADDITIONS, VOLUME 69

Volume 69, Issue 6:

Title Page, line four reads:

Vol. 69	December 1990	No. 5

Replace with:

Vol. 69	December 1990	No. 6

Phytologia (January 1991) 70(1):68.

PUBLICATION DATES FOR VOLUME 69

Volume 69(1): Date on title page–July 1990; Date of mailing–27 July 1990.

Volume 69(2): Date on title page–August 1990; Date of mailing–14 September 1990.

Volume 69(3): Date on title page–September 1990; Date of mailing–17 October 1990.

Volume 69(4): Date on title page–October 1990; Date of mailing–14 November 1990.

Volume 69(5): Date on title page–November 1990; Date of mailing–22 December 1991.

Volume 69(6): Date on title page–December 1990; Date of mailing–6 February 1991.

Information for Authors

Articles from botanical systematics and ecology, including biographical sketches, critical reviews and summaries of literature will be considered for publication in PHYTOLOGIA. Manuscripts may be submitted either on computer diskette, or as typescript. Diskettes will be returned to authors after action has been taken on the manuscript. Diskettes may be 5.25 inches or 3.5 inches but must be written in DOS format as flat ASCII files. Typescript manuscripts should be single spaced and will be read into the computer using a page scanner. The scanner will read standard typewriter fonts but will not read dot matrix print. Manuscripts submitted in dot matrix print cannot be accepted. Use underscore (not italics) for scientific names. Corrections made on typescript manuscripts must be complete and neat as the scanner will not read them otherwise. Language of manuscripts may be either English or Spanish. Figures will be reduced to fit within limits of text pages and therefore, should be submitted with an internal scale and have dimensions proportional to those for text pages. Legends for figures should be included in figures whenever possible. Each manuscript should have an abstract and key word list. Specimen citations should be consistent throughout the manuscript. Serial titles should be cited with abbreviations used in *Botanico Periodicum Huntianum.* References cited only as part of nomenclatural summaries should not appear in Literature Cited. Nomenclatural work should include one paragraph per basionym and must provide proper (as defined by the current *International Code of Botanical Nomenclature)* citation of sources of epithets and combinations.

Authors should arrange for two workers in the appropriate field to review the manuscript before submission. Copies of reviews should be forwarded to the editor with the manuscript. Manuscripts will not be published without review.

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